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THE RÔLE OF THE TOXINS IN INFLAMMATIONS OF THE EYE.[1]

BEING AN ESSAY TO WHICH WAS AWARDED THE BOYLSTON PRIZE.

By Robert L. Randolph, M. D.,

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(From the Pathological Laboratory of the Johns Hopkins University.)

The investigations of Sattler, von Michel, Fick, Weeks, and others have shown that bacteria are constantly present in the normal conjunctival sac, and that these bacteria are not always harmless. It is no uncommon thing to find either the micrococcus lanceolatus or the staphylococcus aureus in a conjunctiva which is, clinically speaking, normal, while Randolph's[2] investigations prove that the micrococcus epidermidis albus (Welch) is an almost constant inhabitant of the normal conjunctival sac.

The researches of Uhthoff and Axenfeld[3] show that the pneumococcus is the most important etiological factor in serpent ulcer of the cornea, and this affection is commonly spoken of nowadays as "pneumococcus ulcer." Such an

[1] This also appeared in the American Journal of the Medical Sciences for November, 1902.

ulcer usually presupposes two conditions—first, a break in the corneal epithelium; and, second, the presence of the pneumococcus, which, as I have said, is often found in the conjunctival sac.

And when I speak of the staphylococcus aureus I am reminded of the records of many unsuccessful cataract operations where failure was traced to the presence of this organism, which there were strong reasons for believing was not introduced into the conjunctiva through blunders in modern operative technique.

The micrococcus epidermidis albus has but slight pathogenic properties, and to this we owe it in large measure that so many eyes survive serious wounds, for this organism has been demonstrated as being generally present in the normal conjunctival sac. Abundance of evidence, then, is at hand to show that the healthy conjunctiva, like the healthy vagina and the healthy intestine, probably contains bacteria at all times.

On the other hand, we know that most inflammations of the conjunctiva are caused by the growth and multiplication, either in the conjunctiva or on its surface, of special bacteria. Trachoma, vernal catarrh, and phlyctenular conjunctivitis have all been thought to originate in special bacteria, and efforts to solve these problems have brought forth much that is valuable, but nothing definite. Personally, I feel quite certain of the parasitic origin of trachoma, but I doubt whether it can be shown that either of the other diseases has its own bacterium. But when we speak of serpent ulcer, acute contagious conjunctivitis or "pink eye," gonorrhœal ophthalmia, and subacute or chronic conjunctivitis we no longer walk on debatable ground, but are in territory whose landmarks are well established, and at once we remember that serpent ulcer is caused by Fraenkel's pneumococcus, "pink eye" by the Koch-Weeks bacillus, gonorrhœal ophthalmia by the gonococcus of Neisser, and subacute or chronic conjunctivitis by the diplobacillus of Morax-Axenfeld.

These are but a few examples which show the relationship which bacteria bear to inflammations of the eye, and as ophthalmic literature of the past ten years is full of proof of this fact, it is unnecessary for me to multiply evidence of this character.

How do these, or in fact any organisms, produce inflammation of the conjunctiva? Either by acting as a foreign body—in other words, by irritating the conjunctiva—or by producing soluble substances, which in their turn act upon the cellular elements of the tissues. It is easy to see that there are decided objections to accepting the view that when organisms produce inflammation of the conjunctiva they do so by acting as foreign bodies, for in that case all organisms would be on pretty much the same footing when present in the conjunctiva, and they would always produce more or less irritation. Then, again, it would be difficult to explain how certain organisms produce more intense reaction than others, for, so far at least as size is concerned, there is no significant difference in the bacteria which we usually find in the conjunctival sac; and we know, too, that in the case of the very organisms which I have mentioned (as causing specific inflammations of the eye) they must have been a certain length of time in contact with the surface of the conjunctiva before the clinical symptoms of inflammation are visible. The mechanical hypothesis, then, if I may so term it, can easily be shaken; while the other hypothesis—the gist of which is that inflammation results from the action of the poisonous products of the organisms upon the cells of the eye—rests upon a much firmer foundation.

It is evident, however, that we are beset with many difficulties when we attempt to prove this experimentally, for we know that the Koch-Weeks bacillus, the gonococcus, and the diphtheria bacillus are peculiar to man, and that these bacteria will produce little or no reaction in the conjunctiva of animals, because the medium is not the proper one for their growth. Heller[3] inoculated the conjunctiva of the newborn rabbit with a gonococcus culture, and claims to have found the organism living in the purulent secretion of the conjunctival sac twenty-four hours after the inoculation. I have repeatedly tried to get a reaction by introducing this organism into the conjunctival sac of the rabbit, but the result of the experiment was always negative, and even when a slight wound of the conjunctiva was made the reaction was very doubtful.

Morax and Elmassian[4] have repeated Heller's experiments, and have occasionally succeeded in getting his results. In order to get the desired reaction one must secure a very virulent race of gonococci—that is to say, the organism must have figured in a very severe case of gonorrhœa. One must introduce as much as possible of the culture (of twenty-four hours' growth) into the conjunctiva. The lids must then be either occluded with collodion or a thread passed through them, and this condition maintained until the next day. But even with conditions so favorable Morax and Elmassian failed to produce an inflammation which was comparable to the gonorrhœal ophthalmia of the human being; and as regards the organism itself, cover-slips gave most unsatisfactory information, while nothing grew from cultures made from the inoculated conjunctival sac.

From all this it would seem clear that it is impossible to produce with the gonococcus in the rabbit's conjunctiva a reaction similar to genuine gonorrhœal ophthalmia, and the same observation holds good for the diphtheria bacillus, the Morax-Axenfeld diplobacillus, and the Koch-Weeks bacillus.

Infectious bacteria produce inflammation in the conjunctiva not only by growing and multiplying in this region, but, in addition, by producing substances called toxins. Toxins, according to Armand Gautier,[5] are chemical substances susceptible of filtration, precipitation, and resolution. They are usually complex, and made up of an alkaloidal material and a nitrogenous substance, which is very active. It must, however, be said, that we have no precise information as to the chemical nature of bacterial

toxins. They are chemically undefined substances which at present can be recognized only by biological tests; these relating especially to their specific effects upon living organisms, including the capacity to lead to the production within the animal body of specific antitoxins.

Inasmuch as we have no multiplication of bacteria, and consequently no formation of toxins, we have an explanation for the absence of inflammation when the bacteria just mentioned are introduced into the conjunctival sac of the rabbit. But when we do get inflammation—as, for instance, when these same bacteria under certain conditions find their way into the human conjunctival sac—what part do the toxins play in causing this inflammation? This is the problem under consideration.

The question as to the part played by the toxins in inflammations of the eye is one which has not led to much discussion, still less to original research. The only experimental studies which have been made on the subject are by Bardelli,[6] Druault and Petit,[7] Henri Coppez,[8] and Morax and Elmassian.[4] The first two communications are very brief, and while suggestive, they cover too little ground to rank with the work either of Coppez or of Morax and Elmassian.

The contribution of Coppez contains an account of experiments made with a view of ascertaining more particularly the manner in which the toxins secreted in the conjunctival sac act upon the cornea. One can take as a typical disease diphtheria of the conjunctiva. He finds that the diphtheritic toxin acts upon the anterior surface of the cornea. The epithelium offers a certain resistance to the action of the toxin, but when the former breaks down the cornea undergoes rapid changes. Anything now which produces a lesion of the anterior surface of the cornea would aggravate the trouble. For example, the epithelium can be injured by the very act of making applications to the eye in the course of the treatment; the constant brushing of the cornea by the false membrane on the upper lid can easily produce a disturbance in the corneal epithelium; and, finally, the action of the toxin itself upon the epithelium, which is often macerated after about forty-eight hours.

Contrary to the results of Gosetti and Iona,[9] the experiments of Coppez demonstrate that the tears have no antiseptic influence upon the diphtheria bacillus. The toxin of diphtheria has a real action upon the cornea.

The streptococcus toxin has very little action upon the cornea, and Coppez has shown that many of the phenomena observed by Bardelli in his experiments were due not to the toxins, but either to the bouillon or to the dead bodies of the microbes, or possibly to the substances which were added to the bouillon in order to kill the microbes. The pneumococcus toxin has also very little effect upon the cornea; and this is due not only, as Druault and Petit believe, to the peculiar or special resistance which the corneal epithelium offers to this toxin, but, above all, to the feebleness of the latter.

The toxins of the staphylococci, the effects of which have also been studied by Soloview and Molodorosky,[10] reproduce on a small scale pretty much the same lesions as the staphylococci themselves.

The most valuable study, however, up to 1899, was made by Morax and Elmassian,[4] and the results of their experiments were embodied in a communication made to the Ninth International Ophthalmological Congress at Utrecht, in August, 1899. These observers instilled into the rabbit's conjunctival sac the toxins of the gonococcus, of the Koch-Weeks bacillus, of the Morax-Axenfeld diplobacillus, and of the staphylococcus. Their work is far more comprehensive than any previous communication upon the subject. They were able to produce in rabbits a conjunctivitis by instilling into the conjunctival sac either a suspension of the dead organisms or the filtrate of these cultures. Of course, these organisms do not multiply in the conjunctival sac of the rabbit; and it is for this reason, as has been stated, that we only get negative results when we try to produce a conjunctivitis in this animal by inoculating with exudates or infectious material taken from the human conjunctiva.

As regards the toxins of the organisms just mentioned, the experiments of Morax and Elmassian show that the ocular mucous membrane of the rabbit reacts under the influence of these toxins very much as does the human conjunctiva. These toxins do not seem to have much penetrating power, as prolonged contact is necessary in order to get the characteristic reaction. The reaction is not immediate, for there is always an interval of two or three hours between the commencement of the instillation and the moment of the appearance of the reactional symptoms. The different toxins do not seem to be characterized by the same kind of reactional symptoms. The reaction following the instillation of the gonococcus toxin was a little more persistent than that of either the Koch-Weeks bacillus or of the diplobacillus, while the toxins of none of these organisms produced so intense a reaction as the diphtheria toxin. These observers made thirty-eight experiments.

In October, 1899, a few weeks before I had seen either the work of Coppez or of Morax and Elmassian, I had commenced an experimental study along these lines. In a work of this character one would naturally select the toxins of those organisms which were known to be concerned in the production of certain ocular inflammations, as, for instance, the gonococcus, the diphtheria bacillus, and the pneumococcus. In addition to these organisms I experimented with the toxins of the staphylococcus aureus, micrococcus epidermidis albus, streptococcus pyogenes, bacillus coli communis, and bacillus xerosis, each of which, with the exception of the micrococcus epidermidis albus, has been placed on record at various times as being more or less concerned in producing inflammation of the eye in some form or other. For example, the staphylococcus aureus is related to a number of inflammatory conditions of the cornea and conjunctiva, being found on the margins of the lids in blepharitis and phlyctenular conjunctivitis. This organism is often found in blennorrhœa of the lacrymal

sac, and in mixed infections in most corneal ulcers except in the so-called "pneumococcus ulcer" (serpent ulcer).

The micrococcus epidermidis albus is a less pathogenic organism than the preceding one; and while I can find no record which would indicate that it was the principal agent in an inflammation of the eye, I am of the opinion that under suitable conditions it is pathogenic, and that in many of our more common conjunctival and corneal troubles, to say nothing of post-operative inflammation, this organism plays a part.

The streptococcus pyogenes is sometimes the cause of corneal ulcer, and it is also concerned in various suppurative processes in the eye. This organism is not infrequently present in purulent dacryocystitis, either alone or mixed with other bacteria, and there is a form of membranous conjunctivitis generally seen in children, and which is caused by the streptococcus, and known as streptococcus diphtheria of the conjunctiva.

The bacillus coli communis is on record as having caused panophthalmitis.[11] Groenouw [12] has observed this organism in catarrhal conjunctivitis of the newborn.

The xerosis bacillus, like the micrococcus epidermidis albus, is often found in the normal conjunctival sac, and, like the latter organism, probably plays a part in many of the inflammations in this locality.

The toxins were obtained by filtration, though sometimes the dead cultures were used.

I have divided this work into four parts: Part I. The effect produced by toxins when they are instilled into the conjunctival sac. Part II. The effect produced by toxins when they are injected into the conjunctiva. Part III. The effect produced by toxins when they are injected into the anterior chamber. Part IV. The bacteriology of the normal conjunctiva of the rabbit, based upon an examination of forty-seven cases.

Part I. The Effect Produced by Toxins when they are Instilled into the Conjunctival Sac.

Technique.—The filtrate was obtained as follows: An inoculation was made from a pure culture of the organism into an Erlenmeyer flask which contained bouillon free of sugar. It is necessary for the bouillon to be free of sugar, as the presence of the latter has been shown to inhibit more or less the production of toxins. The inoculated bouillon is placed in the incubator and allowed to remain there for at least two weeks.

It is well that this amount of time be allowed for the growth of the organisms, for in this way we obtain a filtrate which is much richer in the so-called products of these organisms.

Cultures and cover-slips are then made from this mixture to see whether the original organism is present in pure culture. If these two tests result satisfactorily the fluid is passed through a Pasteur filter into a sterile Erlenmeyer flask. Inoculations are made from this filtrate on "slant agar," and both the tube and the filtrate are placed in the incubator. If at the end of three days there is no growth in the agar, and the filtrate has remained perfectly clear, the evidence is sufficiently conclusive that the filtrate contains no bacteria.

The animal is wrapped up tightly in a towel, which is carried up well around the neck, and in this position the rabbit can be kept absolutely quiet.

When the experiment lasted longer than two hours the animal was allowed to move about on a large table which was free of obstructions, and here the chances of infection were slight as compared to the chances of infection when in either a large cage or in the enclosure with the other animals.

A long sterilized dropper was used to instil the filtrate into the conjunctival sac, and when it was not being used it was kept in a vessel of sterile water.

In those experiments which lasted for two hours and less the conjunctival sac was kept full of the filtrate all the time. When the animal was allowed to run around on the table the instillations were made every few minutes, and in this way the experiment could be started at 8.30 in the morning, and, with the exception of the hour between 12 o'clock and 1 P. M., kept up until 5.30 in the afternoon. None of the experiments lasted longer than eight hours, and the shortest time was fifteen minutes. The animal was kept under the closest observation for two days after the experiment, and anything approaching a reaction was noted. Such, then, was the technique of the experiments performed in this division of the work.

Gonococcus Toxin.—According to Christmas,[13] the gonococcus toxin is found partly in the body of the organism and partly dissolved in the culture medium. It is albuminoid in character, soluble in glycerin, precipitated by strong alcohol, and is destroyed by any considerable exposure to a high temperature. It is possible to produce immunity in animals by inoculating with increasing doses. Wassermann [14] is of the opinion that the toxin is confined to the body of the organism, and that no toxic products are found in the culture medium. He thinks that feeble traces of a toxin in the medium indicate that this toxin has diffused from the dead bodies of the bacteria. He was unable to produce immunity in animals.

Nicolaysen [15] found that the body of the gonococcus contained a toxin which in small doses would kill a mouse, but his filtered cultures appeared to be inert.

Laitinen [16] found only slight evidence of a toxin in the body of the organism. He holds that the filtered culture contains no toxic substance; at any rate, it is so feeble as not to be distinguishable in its effects from those of the culture medium.

Schaeffer [17] seems to be the only one besides Christmas who obtained toxic cultures. He found that the injection of cultures freed of the organisms into the human urethra produced an acute inflammation accompanied with a purulent discharge. He does not seem to have studied the effect of this toxin upon animals. I may add that the inflammatory reaction following the injection of the dead organ-

isms into the urethra has been studied by Panichi[18] and by Scholtz.[19]

It will be seen from this that several investigators failed to get cultures which contained a soluble toxin. Christmas says that this is due to the fact that defective media were employed, and he has shown that slight differences in the composition of the medium and slight deviations in temperature are sufficient to render a culture atoxic.

The observations of Christmas are fully borne out by my experiments, and I am convinced of the existence of a toxin in the filtrate from a gonococcus culture. This fact is brought out very forcibly in the experiments where the filtrate was injected into the conjunctiva. (Part II.)

I stated that the dead cultures of the organisms were used in only a few instances, and in such cases the growth was always on "slant agar" (two parts plain sugar and one part hydrocele fluid). When the growth was eight days old its surface was covered with about an inch of chloroform, which was not poured off for twelve hours. Six hours later, when every trace of the chloroform in the tube had evaporated, the growth was scraped off and mixed up in a test-tube with sterile water or with sterile bouillon. When the filtrate was used the culture medium consisted of one part bouillon and two parts hydrocele fluid.

CASE I.—White rabbit. Instillations of dead cultures mixed with sterile bouillon into the conjunctival sac of both eyes. This was kept up for fifteen minutes, during all of which time the conjunctival sacs were more or less full of the bouillon. *No reaction.*

CASE II.—White and gray rabbit. Both eyes. Instillations lasted for one hour. *No reaction.*

CASE III.—White and black rabbit. Instillations lasted for one and a half hours. *No reaction.*

CASE IV.—White rabbit. Instilled filtrate of gonococcus culture into right eye continuously for two hours. *No reaction.*

CASE V.—Same rabbit. Instilled filtrate into left eye for three hours. *No reaction.*

CASES VI and VII.—Gray rabbit. Here the instillations lasted for five hours, at the end of which time there was decided ocular and palpebral congestion. The instillations in this case were kept up for seven hours, and at the end of this time there was conjunctivitis and slight mucopurulent discharge. A repetition of this experiment in the other eye gave a *negative result.*

CASE VIII.—Gray rabbit. Instilled dead organisms suspended in bouillon for eight hours into right eye. *No reaction.*

At first sight it would appear to be possible to cause a reaction with the gonococcus toxin if the instillations were sufficiently prolonged; but I was unable to repeat this result, and I am led to think that other causes must have co-operated to produce the conjunctivitis. Very probably a tear was made in the conjunctiva during the instillations. It will be observed in the experiments immediately following this one that the instillations were kept up for the same length of time, but with negative results. (See last half of Case VII and also Case VIII.)

Staphylococcus Aureus Toxin.—It will be remembered that the statement was made that in inflammations of the eye this organism was generally found associated with other organisms, and that it occurred in such affections as phlyctenular conjunctivitis, blennorrhœa of the lacrymal sac, and in mixed infections of the cornea. I have never met with a conjunctivitis where there was reason to believe that this organism by itself caused the inflammation.

It has been shown by van de Velde,[20] Kraus,[21] von Lingelsheim,[22] and Neisser and Wechsberg[23] that a soluble toxin —the so-called staphylo-toxin—is secreted by the pyogenic staphylococci, the most interesting property of this toxin being its power to dissolve red and white blood corpuscles.

CASE I.—Gray rabbit. Instillations into the right eye for fifteen minutes, during which time the toxin was constantly in contact with the conjunctiva. *No reaction.*

CASE II.—Black and white rabbit. Right eye. Instillations lasted for one hour, and during this time the filtrate was continuously in contact with the conjunctiva. *No reaction.*

CASE III.—White and gray rabbit. Right eye. Here the instillations were kept up for two hours, and with absolutely *no reactional symptoms.*

CASE IV.—Same rabbit. Left eye. Instillations kept up for five hours. *No reaction.*

CASE V.—Black and white rabbit. Left eye. Instillations continued for eight hours. *No reaction.*

CASE VI.—Gray rabbit. Dead organisms suspended in sterile bouillon. Instillations kept up for eight hours. *No reaction.*

It will be seen, then, from this series of experiments that the instillation of the staphylococcus filtrate into the conjunctival sac, even when the instillations are kept up for eight hours, is followed by no reaction.

Diphtheria Toxin.—I need not recall the fact that the etiology of probably the gravest of conjunctival affections (diphtheritic conjunctivitis) is bound up in the Klebs-Loeffler bacillus. The sugar-free bouillon, in which medium all of my bacteria were cultivated, is according to Spronck and Theobald Smith, a particularly suitable medium for the production of the diphtheria toxin.

CASE I.—White rabbit. Right eye. The conjunctival sac was practically full of the filtrate for fifteen minutes. *No reaction.*

CASE II.—Left eye of the same rabbit. The instillations were kept up for one hour, with *no reaction.*

CASE III.—White and gray rabbit. Right eye. Instillations were kept up for two hours. *No reaction.*

Case IV.—Black rabbit. Right eye. The instillations were kept up for five hours. *No reaction.*

Case V.—Same rabbit. Left eye. Instillations continued for eight hours, with *no reaction.*

Case VI.—Gray rabbit. Right eye. Instillations of dead organisms suspended in sterile bouillon for eight hours. *No reaction.*

Streptococcus Toxin.—Case I.—Instillations for half an hour into the right eye of a white and black rabbit. During all this time the filtrate was in contact with the conjunctiva. *No reaction.*

Case II.—Same rabbit. Instillations for two hours into the left eye. *No reaction.*

Case III.—White rabbit. Right eye. Instillations for three hours, with absolutely *no reaction.*

Case IV.—Same rabbit. Instillations for four hours into the left eye, with *no reaction.*

Case V.—Gray rabbit. Right eye. Instillations for five hours. *No reaction.*

I cannot say that I was surprised at the results of the experiments in this series, for we know that subcutaneous injections of the organisms into rabbits and mice are, as a rule, without either local or general manifestations of importance. The organism is not particularly pathogenic for animals.

Bacillus Coli Communis Toxin.—This is another organism which is not supposed to possess a soluble toxin, and which in this respect resembles the gonococcus and the pyogenic cocci. It may be interesting to recall a very recent communication by Victor C. Vaughan,[24] of Ann Arbor. This observer in his study of the bacterial toxins devoted a good deal of time to the bacillus coli communis. He finds that the toxin is contained within the cell, from which it does not, at least under ordinary circumstances, diffuse into the culture medium, and that it is not extracted from the cell by alcohol, by ether, or by dilute alkalies. The unbroken germs may be heated to a high temperature with water without destruction of the toxin, and the same result follows boiling with a 0.2 per cent aqueous solution of hydrochloric acid; but when the acid is increased from 1 to 5 per cent the cell wall is broken up and the toxicity lessened, but not destroyed.

The toxin separated from the cell wall by digestion of the latter with hydrochloric acid and pepsin is markedly active.

It will be remembered that this organism has been discovered in pure culture in a case of panophthalmitis, and that several observers report its occurrence in unusual forms of conjunctivitis.

Case I.—Gray rabbit. Right eye. Instillations lasted for fifteen minutes, and the contact was constant. *No reaction.*

Case II.—Same rabbit. Left eye. Instillations for one hour. *No reaction.*

Case III.—Black and white rabbit. Instillations for two hours into the right eye, and during this time the contact of the filtrate with the conjunctiva was constant. *No reaction.*

Case IV.—Same rabbit. Left eye. Instillations kept up five hours. *No reaction.*

Case V.—Left eye of rabbit used in Case I. Instillations kept up for eight hours. *No reaction.*

A negative result, then, was obtained in every case in this series. Even when the instillations are kept up practically all day the conjunctiva gives no evidence of inflammation.

Pneumococcus Toxin.—Case I.—White rabbit. Right eye. Instillations kept up for fifteen minutes. *No reaction.*

Case II.—Same rabbit. Left eye. Instillations for one hour, with *no reaction.*

Case III.—Black rabbit. Right eye. Instillations for three hours. Absolutely *no sign of reaction.*

Case IV.—Same rabbit. Left eye. Instillations kept up for five hours, with the *same result as in Case III.*

Micrococcus Epidermidis Albus Toxin.—This organism has been found by a number of observers in the normal conjunctiva, and by Randolph [1] eighty-eight times out of a hundred individuals whose conjunctivæ were examined.

Case I.—White rabbit. Right eye. Instillations for one hour, during which time the contact was constant. *No reaction.*

Case II.—Same rabbit. Left eye. Instillations for two hours. *No reaction.*

Case III.—Black and white rabbit. Instillations into both eyes for three hours. *No reaction.*

Case IV.—Same rabbit. Instillations into right eye for seven hours. *No reaction.*

As might have been expected from the results obtained in the preceding series, I was unable to get a conjunctivitis by prolonged instillations with the filtrate of this organism.

Xerosis Bacillus Toxin.—This organism, which morphologically is so much like the diphtheria bacillus, is frequently found in the normal conjunctiva, and, like the white skin coccus, is no doubt concerned in many of the more common external eye inflammations.

Case I.—Right eye. Instillations for one hour, during which time the filtrate was in constant contact with the conjunctiva. *No reaction.*

Case II.—Same rabbit. Left eye. Instillations for two hours. *No reaction.*

Case III.—White and gray rabbit. Instillations for four hours into right eye. *No reaction.*

Case IV.—Same rabbit. Left eye. Instillations for five hours. *No reaction.*

It will be seen that forty experiments were performed in this part of the work. In many instances the filtrate was kept in constant contact with the conjunctiva for hours, and only once did I succeed in exciting a conjunctivitis (Case I, p. 53); and I think the interpretation which I gave of this case is probably the proper one—an interpretation which is strengthened by the uniformly negative results obtained in the other thirty-nine cases.

With the exception, then, of this case, the results of the instillations of the filtrates into the conjunctival sac are directly opposed to the results which were obtained by Morax and Elmassian.

PART II. THE EFFECT PRODUCED BY TOXINS WHEN THEY ARE INJECTED INTO THE CONJUNCTIVA.

There is probably no part of the body which is as able to fight with infectious bacteria as the eye. When we consider how frequently the eyeball is wounded not only by accidents, but also by operative measures, and how comparatively seldom pathogenic infection results, we are forced to the conclusion that the eye must enjoy immunity to a high degree. This immunity or resistance to disease is partly accounted for, no doubt, by the exceptional activity of the leucocytes of the eye. This activity is remarkable in the case of the rabbit's eye, in which animal a considerable wound of the cornea will in twenty-four or forty-eight hours have vanished and left hardly a trace.

In our daily practice we often see the same thing to a less marked degree, and it suggests that the strength of the eye lies not only in the peculiar activity of its leucocytes, but also in the properties of its fluids, which are probably to some extent antibacterial. I need not bring forward evidence to show how much happier have been the issues from operations upon the eye since the advent of Listerism and of all that this word means. That goes without saying, but I think I am quite safe in saying that Listerism found no part of the body so well equipped to take care of its bacteria as the eye. While the mortality (if I may use the word) is less nowadays, the difference in this respect is much less startling than it is in the other fields of surgery.

It is perfectly clear from a study of the foregoing experiments that the rabbit's eye is quite able to withstand the harmful effects of the instillation of toxins upon its surface, no matter if these installations are kept up practically all day. The question is, can this immunity of the eye nullify the effects of these toxins when they are injected into or have gained a foothold in the tissues?

Technique.—The syringe and fixation forceps were boiled five minutes. The eye of the rabbit was anæsthetized with holocaine. The animal was always wrapped in a towel, as in the first series of experiments, in order to keep it immovable. The operation was apparently painless.

In the first place, the conjunctivae of five eyes were injected with sterile bouillon, to see whether any reaction could be produced by the medium. Varying quantities were injected, up to as much as a syringeful.

With the exception of one case in which there was some difficulty in penetrating the conjunctiva, and where there was, in consequence, bruising of the latter, there was no reaction. In the case mentioned it was noticed that the syringe leaked. It was withdrawn, and on inserting it again the conjunctiva was torn.

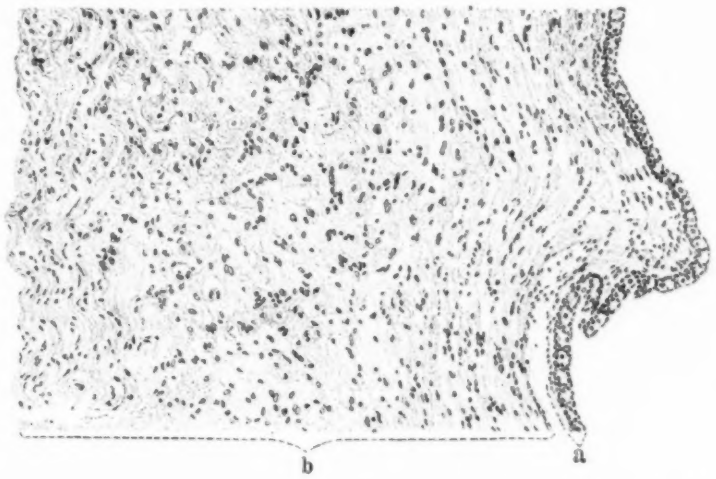

FIG. 1.—Section from the normal conjunctiva of the rabbit. (Zeiss, oc. 4; obj. a a. Enlarged 90 times.) *a*. Epithelial layer. *b*. Connective-tissue layer.

I always endeavored to make the injection at one point in the conjunctiva, which at this location at once puffed up and looked like a big blister.

The operations were performed in the afternoon, and the eyes were examined the next day at the same time.

There was no particular point selected for the injection, though usually it was made above the cornea, at about half an inch from the margin of the latter.

Gonococcus Toxin.—CASE I.—Gray rabbit. Injected ten drops of filtrate into the conjunctiva of the right eye, and into the conjunctiva of the left eye the same quantity of sterile bouillon. The next day there was intense reaction in the right eye and no reaction in the other eye.

CASE II.—Gray rabbit. Right eye. Injected eight drops into the conjunctiva. The next day there was marked con-

gestion of the upper half of the eyeball, much more intense at the point of penetration.

Case III.—White and black rabbit. Right eye. Injected five drops of the filtrate. Conjunctivitis possibly not so marked as in either of the last cases.

Case IV. Same rabbit. Injected three drops of the filtrate. The next day a slight redness near point of injection, covering about a fourth of the globe.

Diphtheria Toxin.—Case I.—White rabbit. Injected ten drops of filtrate into the conjunctiva of the right eye and ten drops of sterile bouillon into the left. At the end of twenty-four hours there was intense reaction in the right

Fig. 2.—Conjunctivitis. Gonococcus toxin. Case I. (Zeiss, oc. 4; obj. a a. Enlarged 90 times.) *a* Connective-tissue layer. *b.* Pistended blood-vessels. *c.* Epithelial layer. *d.* Large exudate resting upon the epithelial layer. *e.* Area in connective-tissue layer crammed with leucocytes and round cells.

eye. There was an almost typical picture of diphtheritic conjunctivitis. The swelling of the lids was so great that the animal could not open its eye. When the lids were forcibly opened there was a welling up of a purulent discharge, and there was a strong suggestion of a membrane on the upper lid. The cornea was rather dull. The left eye, into which ten drops of sterile bouillon had been injected, showed no reaction. This was the only case in which I obtained a reaction which resembled the picture seen in the human being. The same filtrate was used for an instillation experiment and the instillations kept up nearly all day, but with negative result.

Welch and Flexner have shown that the poison producing the false membrane is an intracellular one, and not the soluble toxin, so that a definite pseudomembrane is not to be expected after injecting the latter alone.

Case II.—White rabbit. Right eye. Injected eight drops of the filtrate. The next day there was marked conjunctivitis, with possibly a little excess of secretion.

Case III.—Same rabbit. One week later. Injected into left eye six drops of filtrate. Twenty-four hours later there was conjunctivitis which did not differ materially from the condition which was seen in Case II.

Case IV.—White and black rabbit. Left eye. Injected three drops of filtrate. The next day there was conjunctivitis which consisted in simple congestion of the upper half of the eyeball, with no discharge.

Pneumococcus Toxin.—Case I.—White rabbit. Injected fifteen drops of filtrate into the conjunctiva of the right

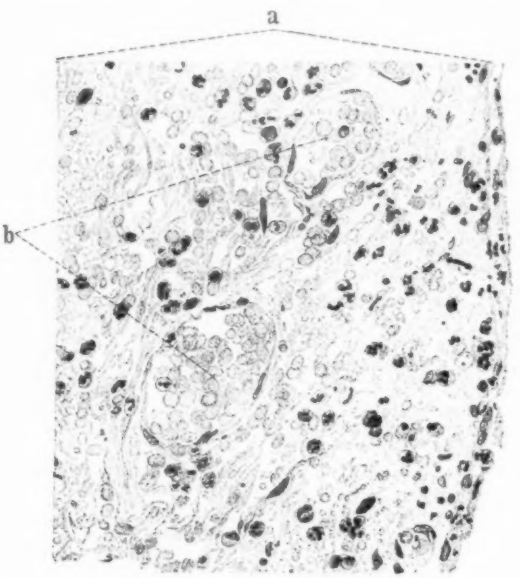

Fig. 3.—Conjunctivitis. Intense hemorrhagic inflammation. Diphtheria toxin. Case I. (Zeiss, obj. D D; oc. 4; enlarged 420 times.) *g.* Connective-tissue layer which is very œdematous. Red blood corpuscles and polynuclear leucocytes may be seen everywhere throughout this section. *b.* Engorged blood-vessels.

eye and the same quantity of sterile bouillon into the conjunctiva of the left eye. The next day the right eye showed marked conjunctivitis which extended over the entire eyeball, while the result of the injection in the left eye was negative.

Case II.—Injected left eye of the same rabbit. Eight drops of filtrate were used. Twenty-four hours later conjunctivitis, with no increased secretion.

Case III.—White and black rabbit. Injected six drops of filtrate into the conjunctiva. The next day there was conjunctivitis which did not differ materially from the condition in the preceding case.

Case IV.—Same rabbit. Left eye. Injected three drops

of filtrate. The next day there was redness of the conjunctiva near the point of the injection, but the inflammation in this case was very localized.

Streptococcus Toxin.—CASE I.—Injected fifteen drops of filtrate into the conjunctiva of the right eye and the same quantity of sterile bouillon into the conjunctiva of the left eye. Next day pronounced conjunctivitis, which was uniformly distributed. The left eye showed no change.

CASE II.—Same rabbit. Few days later. Injected ten drops of filtrate into left eye. Conjunctivitis the next day. Possibly somewhat less marked than in the preceding case.

CASE III.—White rabbit. Injected ten drops of filtrate into right eye. The next day conjunctivitis, which was pretty uniformly distributed.

CASE IV.—Same rabbit. Left eye. Injected eight drops of filtrate. Next day there was conjunctivitis which differed very little from the reaction seen in Case III.

CASE V.—White and black rabbit. Right eye. Injected five drops of filtrate. Next day there was slight conjunctivitis.

Staphylococcus Aureus Toxin.—CASE I.—White rabbit. Injected into the right eye fifteen drops of filtrate. The next day there was marked conjunctivitis which differed in no respect from the conjunctivitis which was seen in Case I in the preceding series. The other eye, into which the same quantity of sterile bouillon was injected, showed no reaction.

CASE II.—White and gray rabbit. Injected ten drops of filtrate into right eye and the same quantity of sterile bouillon into the left eye. The next day the right eye showed conjunctivitis. There was also some congestion of the left eye, but I am disposed to attribute the reaction in this eye either to bruising of the tissues or to some accidental infection which occurred after the experiment.

CASE III.—Same rabbit. One week later. Injected eight drops of filtrate into left eye. The next day there was conjunctivitis, but not nearly so marked as in Case I.

CASE IV.—White and black rabbit. Right eye. Injected five drops into the conjunctiva of this eye and five drops of sterile bouillon into the conjunctiva of the left eye. Slight conjunctivitis in the right eye and no reaction in the left eye.

Bacillus Coli Communis Toxin.—CASE I.—Black rabbit. Injected fifteen drops of filtrate into the right eye and the same quantity of sterile bouillon into the left. The next day there was almost as intense a reaction in the right eye as was seen when ten drops of the gonococcus and diphtheria toxins were used. The left eye showed no reaction.

CASE II.—Same rabbit. Left eye. Injected ten drops into the conjunctiva. The next day there was quite a marked conjunctivitis.

CASE III.—White and black rabbit. Right eye. Injected eight drops of filtrate. The next day there was conjunctivitis not differing materially from what was seen in the preceding case.

CASE IV.—White rabbit. Injected three drops into the conjunctiva of left eye. The next day there was slight congestion in the upper half of the eyeball, more marked near the point of the injection.

Xerosis Bacillus Toxin.—CASE I.—White rabbit. Injected fifteen drops of filtrate into the right eye and fifteen drops of sterile bouillon into the left. The next day there was marked conjunctivitis in the right eye and no reaction in the left eye.

CASE II.—Same rabbit. Left eye, a few days later. Ten drops of filtrate injected. Conjunctivitis, but less marked than in the preceding case.

CASE III.—White rabbit. Injected into the right eye five drops of filtrate. Next day there was conjunctivitis not differing materially from Case II.

Micrococcus Epidermidis Albus Toxin.—Three experiments were performed in this series, and they resulted practically as did those in which the xerosis bacillus was employed.

It will be seen that thirty-one experiments were performed in this series, with a positive result in every case—a marked contrast to the results which were obtained in Part I.

I have more than once recalled the fact that several of the organisms with which I have experimented are not supposed to produce soluble toxins. The uniformly positive results which were obtained in Part II suggested that possibly the effect produced was due to the presence in the filtrate of some of the so-called bacterio-proteins described by Buchner, and which are distinctly irritating. These products are incorporated in the substance of the bacterial cells, and are set free especially from degenerated or dead bacteria. The older a culture the greater the number of dead or degenerated bacteria which it contains. It is evident, then, that these bacterio-proteins are more abundant in a culture say of two weeks' growth than in one which is only twenty-four hours old. It will be remembered that my cultures were usually allowed to remain undisturbed for two weeks, as in this time I obtained a more concentrated culture, and consequently a more satisfactory filtrate.

To eliminate to a considerable extent the agency of these bacterio-proteins the cultures were filtered when they were only twenty-four hours old. Five experiments were made with a filtrate of this character.

CASE I.—White rabbit. Ten drops of filtrate were injected into the conjunctiva of the right eye. Same quantity of sterile bouillon was injected into the conjunctiva of the left eye. The next day there was a well-marked redness of the right eyeball, while the left eye showed no change. The toxin in this case was of *staphylococcus pyogenes aureus.*

CASE II.—*Same Toxin.* Same rabbit. Left eye. Ten drops of filtrate were injected. The result was the same as in Case I.

Bacillus Coli Communis.—CASE I.—White and gray rabbit. Right eye. Injected ten drops of filtrate into the conjunctiva. A decided conjunctivitis followed.

CASE II.—Same rabbit. Left eye. Ten drops of filtrate

were injected into the conjunctiva. Next day there was a slight conjunctivitis.

Diphtheria Toxin.—Case I.—Black rabbit. Right eye. Injected ten drops of filtrate into the conjunctiva and the same quantity of sterile bouillon into the conjunctiva of the other eye. There was a conjunctivitis in the right eye the next day and slight redness of the fellow eye, which latter condition I interpreted as being due, in all probability, to some mechanical injury of the conjunctiva at the injection.

It will be seen from this that the elimination to a large extent from the filtrate of the bacterio-proteins had scarcely more than an appreciable effect upon the character of the reaction. In these last five cases the congestion of the conjunctiva was possibly a little more localized around the point of the injection than was the case in the other experiments of this division of the work, and this we might interpret as being due in part to the feebler concentration of the culture as well as to the smaller quantity of bacterio-proteins.

Part III. The Effect of the Toxins when they are Injected into the Anterior Chamber.

The following was made as a control experiment: A Graefe cataract knife was passed into the cornea at its upper scleral border. Through this incision ten drops of sterile bouillon were injected into the anterior chamber. The next day, with the exception of a very small hernia of the iris and three or four vessels grouped at the point of the wound, the eye was normal. On the second day the congestion had entirely disappeared, but the slight irregularity in the pupil persisted, and this is due to the incarceration of the iris in the lips of the incision, and it will never disappear. There was, however, not the slightest sign of an iritis.

The following experiments were then made:

Gonococcus Toxin.—Case I.—White rabbit. Right eye. Anterior chamber was opened as in the preceding case and five drops of the filtrate injected from a hypodermic syringe. The next day there was pericorneal congestion, which was more marked at the point of the incision. The aqueous was slightly cloudy. Iritis. In seven days the symptoms had entirely disappeared.

Diphtheria Toxin.—Case II.—Same rabbit, ten days later. Left eye was utilized. An incision was made in the usual manner above, just as we do in a cataract incision, except that the incision in the experiment is, of course, much smaller. Ten drops of the filtrate were injected through this incision into the anterior chamber. The next day there was a very intense iritis, showing itself in practically the same symptoms as in Case I. The eye had cleared up in a week.

Bacillus Coli Communis Toxin.—Case III.—Gray rabbit. Injected ten drops of filtrate into the anterior chamber above. Next day there was iritis, with the usual symptoms.

Pneumococcus Toxin.—Case IV.—Gray rabbit. Left eye. Injected into the anterior chamber ten drops of the filtrate. In twenty-four hours there was iritis, which did not differ materially from what was seen in Case II.

Staphylococcus Aureus Toxin.—Case V.—White and black rabbit. Right eye. Ten drops of filtrate were injected into the anterior chamber. Result was the same as in the last two cases.

Micrococcus Epidermidis Albus Toxin.—Case VI.—Ten days later fifteen drops of the filtrate were injected into the anterior chamber of the left eye. I saw no material difference in the reaction from that in the preceding case.

At first sight one would suppose that the reaction in experiments of this character would be more intense, more destructive than when the injection was made into the conjunctiva. The absence of panophthalmitis and closed pupil is explained by the fact that some at least of the filtrate oozed out of the anterior chamber. As long as the wound was open, and no doubt it remained so for several hours, there was more or less oozing. The filtrate which remained was certainly considerably diluted by the rapidly regenerating aqueous, so the toxin in its original condition remained for a very brief space of time in the anterior chamber, but quite long enough to light up inflammation; and no doubt is left in my mind that had I injected the toxin through a needle-hole opening right into the anterior chamber serious results would have followed, for in this case the tension of the eye would have been markedly increased, and the toxin would have been retained.

In the conjunctival injections the needle-hole closed on withdrawing the needle, and there was apparently no oozing, the bleb remaining for some little time after the experiment.

We have evidence enough to show, then, that the filtrate from the cultures of the organisms which were used in these experiments is sufficiently irritating to set up inflammation in the conjunctiva and in the iris. That the bacteria in the rabbit's conjunctiva play a part in this inflammation is almost certain. The effect of the toxin is simply to irritate, and in this way to lessen local resistance. We know that the normal human conjunctiva is rarely if ever free of bacteria, several of which have very slight pathogenic properties, but that when an irritant is applied to the eyeball the conditions are at once produced under which these very organisms become pathogenic and do harm.

Mention has been made of several works upon the bacteriology of the normal human conjunctiva; but, so far as I know, no work has been done upon the bacteriology of the rabbit's conjunctiva—an important omission when we consider that practically all of the experimental work of the ophthalmologist is done upon the rabbit's eye.

It has occurred to me, in this connection, to make an examination of the normal conjunctiva of the rabbit, to see whether its bacteriology resembles that of the human conjunctiva, and this brings me to Part IV.

PART IV. THE BACTERIOLOGY OF THE NORMAL CONJUNCTIVA OF THE RABBIT BASED UPON AN EXAMINATION OF FORTY-SEVEN CASES.

The technique consisted in rubbing a rather large, sterile platinum loop over the conjunctiva of the eyeball, and carrying it well into the conjunctival sac, from which points inoculations were made into the fluid agar. Plate cultures were always made.

1. Two whitish, well-defined colonies; both micrococci.

2. Two colonies; one evidently an impurity, the other a micrococcus.

3. One colony; micrococcus, which was like the coccus found in 1 and 2.

4. One colony; similar to 3.

5. Several small colonies; whitish; all proved to be micrococci.

6. Coccus similar to preceding; a large bacillus.

7. Plate was covered with small colonies; micrococcus like 1 and 2.

8. Several colonies. The large colored ones proved to be a big bacillus. There was a streptococcus colony; also a micrococcus similar to 1 and 2.

9. Four colonies, all of which were micrococci.

10. Two colonies; one proved to be a bacillus, the other a micrococcus.

11. Micrococcus, like the preceding; also a large, yellowish colony, proving to be a big bacillus.

12. A colony which covered a large area, proving to be a big bacillus; also a micrococcus.

13. Several yellowish colonies; bacilli of different sizes.

14. Several yellowish colonies, which proved to be a short bacillus; also a number of whitish colonies, which were micrococci like 1 and 2.

15. A number of colonies; all micrococci like those seen in 14.

16. Abundant growth; micrococci like the preceding.

17. Abundant growth; micrococci like the preceding.

18. Several colonies; micrococci like the preceding.

19. Two colonies, one of which was a large bacillus and the other a large coccus.

20. One large colony, which proved to be a large coccus, and several smaller colonies, which proved to be micrococci like those frequently seen in preceding cases.

21. Several colonies; micrococcus.

22. Several colonies; micrococcus.

23. One colony; micrococcus.

24. One large colony, which proved to be a big, short bacillus.

25. Several colonies; micrococci like those in 1 and 2.

26. Several colonies; micrococci like the preceding. There was a yellowish colony in this plate, but an examination of the organism showed it to be a micrococcus not differing morphologically from the other coccus.

27. Two colonies, one whitish and the other yellowish-white; micrococci which did not differ morphologically.

28. Nothing grew in this plate.

29. One large colony, covering half the plate, which proved to be *Bacillus subtilis*. There were other small colonies in this plate, some of which were micrococci like 1 and 2, and others were very small bacilli.

30. Three colonies, which proved to be very fine bacilli.

31. Several colonies. One was a large coccus and the others were short bacilli.

32. A number of colonies which were sharply round and white, some consisting of a large coccus, and others were micrococci.

33. Several colonies, consisting, for the most part, of diplococci and large cocci.

34. Two colonies; both diplococci.

35. Several colonies; micrococcus like that in 1 and 2; fine streptococcus.

36. Micrococcus similar to 1 and 2.

37. A number of colonies, consisting for the most part of micrococci like those in 1 and 2; also a fine streptococcus.

38. A number of colonies; micrococci like 1 and 2.

39. Rather large coccus. A number of other colonies, which were micrococci like 1 and 2.

40. Two colonies. One was a large coccus, while the other was a micrococcus like 1 and 2.

41. A number of colonies, most of which were micrococci like 1 and 2. There was also a growth which proved to be a fine streptococcus.

42. Large number of colonies which proved to be a big coccus, and one colony which was a fine streptococcus.

43. One colony; micrococcus like 1 and 2.

44. Several colonies; large coccus; micrococcus like 1 and 2.

45. Number of colonies; same micrococcus as in 1 and 2.

46. Number of colonies; same micrococcus as in 1 and 2.

47. Number of colonies; same micrococcus as in 1 and 2.

From a study of these cases it appears that the normal conjunctiva of the rabbit contains quite a variety of bacteria. There was more often found, however, a micrococcus which proved to be the staphylococcus albus. This organism occurred in thirty-six out of the forty-seven cases (1, 2, 3, 4, 5, 6, 7, 8, 9, 12, 14, 15, 16, 17, 18, 20, 21, 22, 23, 25, 26, 27, 29, 32, 35, 36, 37, 38, 39, 40, 41, 43, 44, 45, 46, 47).

The staphylococcus albus, as we know, is feebly pathogenic; but given sufficient irritation it can and often does produce inflammation, and it is reasonable to presume that this organism was frequently concerned in causing the conjunctivitis and iritis recorded in Parts II and III.

At any rate, the normal conjunctiva of the rabbit, like the normal human conjunctiva, is probably never sterile. In only one case (Case XXVIII) was there a sterile plate.

EPICRITICAL OBSERVATIONS.—The foregoing experiments are of interest in several respects. The forty experiments recorded in Part I indicate that simple contact of bacterial toxins with the normal conjunctiva produces no local inflammation or other injury to the animal. This is in accordance with what is already known concerning the behavior of this

class of poisons when applied to other intact mucous surfaces. Unlike alkaloidal and many other kinds of poisons, the chemically undefined toxins produced by bacterial cells, as well as similar toxins produced by certain cells of higher plants (ricin, abrin) and of animals (snake venom), are in general incapable of absorption from intact mucous surfaces, although before the present series of experiments this had not been satisfactorily demonstrated in the case of the conjunctival mucous membrane.

Not only are the toxins not absorbed under these circumstances, but they do no damage to the intact epithelium. In fact, it is probably this absence of local injury induced by the bacterial toxins which explains the lack of absorption of the toxins. That there are special epithelio-toxins capable of damaging epithelial cells has been demonstrated by von Dungern[25] and others, but such specific toxins for epithelium have not been discovered in filtrates of bacterial cultures. We know, however, that certain bacterial toxins, notably the diphtheria toxin, may act injuriously upon previously altered epithelial cells, and further investigations may show the existence of bacterial toxins capable of directly injuring intact epithelium.

The experiments recorded in this paper, therefore, indicate the great importance of integrity of the epithelial surfaces in protecting against local and general injuries from toxins secreted by bacteria. We were already familiar with this protective influence in guarding against local and general infections by the bacteria themselves, although there are bacteria which can attack the normal epithelium. Inasmuch as bacteria in general are more virulent when they are accompanied by their toxins at the time of their invading the animal body, it seemed important to determine, as has been done in this paper, the action of the toxins separated from the bacteria upon the intact conjunctival membrane.

To what extent the protection afforded by intact epithelium against bacterial toxins is purely mechanical, or is due to incapacity of the toxin to enter into a chemical union with the epithelial cell in the sense of Ehrlich's "side-chain" theory or to other causes, I have not attempted to determine. When, however, the toxin has gained access to the subepithelial tissues we find the conditions entirely different.

The numerous experiments recorded in Part II demonstrate that filtrates from both young and old cultures of all the various bacterial species used contain some irritative poison capable of setting up local inflammation when these filtrates are injected into the substance of the conjunctival mucous membrane. Certain of the bacterial species employed produced more powerful irritative poisons than others, the strongest of these toxins being found, in the present experiments, in cultures of the gonococcus, the diphtheria bacillus, and the colon bacillus, but notable effects were obtained with cultures of the pyogenic micrococci.

That the substances concerned in producing these local inflammations are specific products of the bacteria, and are not attributable to ingredients of the original culture media, was abundantly demonstrated by the fact that control injections of the uninoculated culture media even in much larger doses were entirely without any injurious effect.

It is possible that bacteria normally present in the rabbit's conjunctival sac may have participated in causing the inflammations which regularly followed the injections of the toxins into the conjunctival membrane. In Part IV, I have shown that the normal conjunctival sac of the rabbit contains a variety of bacteria, and that among these a white staphylococcus resembling if not identical with the staphylococcus albus (staphylococcus epidermidis albus) is common. But the primary and essential damage is that which is inflicted by the toxin, as the control experiments show; and if bacteria were secondarily active it is because the soil was prepared for them by the damage done to the cells and tissues by the toxins.

I can readily understand that such ordinarily harmless bacteria as the white staphylococcus or other common bacterial inhabitants of the conjunctival sac may gain a foothold and multiply in tissues whose vital resistance has been impaired by the previous action of toxins.

After it had been determined that bacterial toxins introduced into the connective tissue of the conjunctiva cause inflammation it was not surprising to find that a similar result followed the injection of the same toxins into the anterior chamber of the eye, as is demonstrated by the experiments recorded in Part III.

There is another aspect of the experiments which is of considerable interest. Filtrates were used from cultures not only of bacteria known to produce powerful soluble toxins, but also of those not before positively known to secrete soluble toxins. Inasmuch as we have at present no means of determining whether a given bacterium secretes a toxin or not, except by the biological test, it has been generally assumed that when this test fails there is no evidence of the existence of such a toxin. But it may be asked whether in all instances sufficiently delicate tests have been made?

The need of caution in drawing conclusions in this matter is made evident by the interesting experiments of Kraus,[26] who has shown that specific soluble bacterial products previously unsuspected are present in the fluid cultures of the typhoid bacillus, the cholera bacillus, and other bacteria, and can be revealed by the action of the homologous antiserum. That toxins may have peculiar specific effects upon certain cells, and that these effects may be of such a nature that they are readily overlooked until careful search is made for them, has been shown by the discovery in recent years of the various cytolysins produced by the pyogenic staphylococci and the tetanus bacillus.

It is from this point of view of interest that all of the bacteria which I employed were demonstrated to produce toxins capable of causing injury and inflammation of the tissues of the conjunctiva. Injection into the eye, particularly into the substance of the conjunctiva, would seem, therefore, to make a more delicate biological test for the recognition of certain toxins than the tests which have usually been

employed to determine this point. That the toxins concerned were not simply the so-called bacterio-proteins of Buchner, derived from degenerated and macerated bacterial cells, was proven by the determination of the toxicity of young cultures.

The experiments recorded in this paper are in harmony with clinical experience, and they shed some light upon questions of clinical interest. We know that in a large proportion of cases of infectious inflammations of the eye a lesion of continuity is demonstrable or can reasonably be inferred. This lesion is now shown to be important not only in opening a path for the invasion of bacteria and in weakening the local vital resistance to bacteria, but also in permitting the entrance of toxins which constitute the weapons by which the bacterial cells do injury. Without this opportunity for the penetration and action of toxins even highly virulent bacteria may be harmless, as has been shown in the case of the tetanus bacillus, and with this opportunity bacteria of even very weak virulence, such as the common white staphylococcus, may be pathogenic. In support of these views I need not dwell upon conditions where the injury is manifest, as in postoperative inflammations, penetrating wounds of the eyeball, serpent ulcer, etc. I am of the opinion that many cases of gonorrhœal ophthalmia and of "pink eye" are produced not by the simple introduction of the specific bacterium into the healthy conjunctival sac, but by the bacterium acting upon a conjunctiva slightly injured, even if the injury be no more than the slight abrasion of the conjunctival epithelium which may result from rubbing the eyes with the fingers. I have seen in the last two years two cases of gonorrhœal ophthalmia resulting from the spurting of fluid from a pyosalpinx into the eye of the operator, and in each instance this accident was followed by violent rubbing of the eye, which would produce a lesion of the conjunctival epithelium.

How often we meet with gonorrhœal ophthalmia as a monolateral affection!—in fact, in the majority of cases. What a very common disease is gonorrhœa, and how comparatively infrequent is gonorrhœal ophthalmia!

It can hardly be otherwise than that the gonorrhœal virus often gains access to the conjunctival sac without setting up inflammation.

It must often happen in cases of highly infectious inflammations of one eye that the infectious germs are conveyed to the other eye without resulting injury. While every precaution should be taken to guard against such a contingency, it is probable that our protective measures are effective in many instances as much by preventing slight local abrasions as by the exclusion of the infectious bacteria.

We know that it is scarcely within the power of the surgeon to exclude absolutely all bacteria from wounds, and that in so-called aseptic wounds bacteria, sometimes even pathogenic forms, are present. Nothing is easier than the entrance of bacteria into the conjunctival sac, nor can we rid the sac entirely of micro-organisms. Whether or not bacteria already present do harm depends upon a number of circumstances, and among the most important of these circumstances is the condition as regards integrity of the conjunctival surface.

My experiments have demonstrated, I think, the importance of this factor in relation to toxins; and also that pathogenic bacteria, even those for which toxins had not previously been satisfactorily demonstrated, do harm through the action of specific soluble poisons.

What, then, is the conclusion of the whole matter?

1. Bacterial toxins, so far as tested, when instilled even for many hours into the healthy conjunctival sac were found incapable of producing inflammation or causing other injury.

2. The same toxins when injected into the tissue of the conjunctiva or into the anterior chamber invariably set up local inflammation, the extent and intensity of the inflammation varying to some degree, according to the species of bacterium yielding the toxin.

3. Bacteria which had not previously been proven to produce soluble toxins were found to produce them even in young cultures, and it is suggested that injections of bacterial filtrates into the eye, particularly into the conjunctival tissue, constitute a more delicate biological test for the detection of certain toxins than the tests usually employed for this purpose.

4. The experiments recorded in this paper furnish additional examples, in a comparatively new field, of the importance of toxins in explaining the pathogenic action of bacteria, and likewise emphasize the etiological significance of injuries of the covering membrane of the eye in favoring the action of toxins and of bacteria.

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PLAGUE IN THE ORIENT.

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As plague has periodically recurred in pandemic form, lasting from several years to fifty or sixty years, has formed new endemic homes, and of late has reappeared in Asia to spread to all parts of the world, making many new distributing points and establishing many temporary endemic centers, its mode of self-perpetuation, extension and the geographical and sociological conditions best suited to facilitate these phenomena are questions of paramount importance in these, the early years of the present pandemic.

In this paper a brief discussion of some features of *Bacillus pestis* and the infection in animals and insects is necessary. Its viability and virulence are most important. Numerous observers have recorded its long life and resistance to various injurious influences. Organisms have remained alive in culture media for many months; on dried pulverized organs of animals dead of plague for forty-eight days; on dried paper in a thermostat for forty-four days; on paper, silk, etc., in a room at ordinary temperature in sunlight for eighteen days, and in direct sunlight for from four to five hours. Its virulence is also long maintained. Old cultures are frequently as virulent as young ones. Full virulence has been noted after forty-eight days in dried organs and after seventeen days in dry paper in a thermostat. Most of the lower animals and some insects are susceptible to plague; rats, mice, fleas and flies are, perhaps, of most importance. These animals and insects preserve the virulence of the organism, spread it in excreta and their decaying cadavers and pick up virulent organisms in food-stuff, raw goods and various kinds of infected material. Rats suffering from gangrene or an old ulcer following a suppurating bubo may preserve the life and virulence of the organism for a long time and spread it from place to place. The long life of the organism and its maintenance of virulency are sufficient to explain the introduction of the disease into distant lands and to furnish infection for a succeeding annual epidemic. The occurrence of an occasional case of plague in a previously infected city may furnish a fresh culture of *Bacillus pestis*. Lastly, a very small number of bacilli may produce infection in a superficial, even microscopic, wound.

Regarding direct and indirect transmission of plague, it may be said that indirect transmission plays the most important role. It has been noted by all observers that those, apparently, most exposed to infection rarely contract the disease. The high resistance of the organism to various harmful agencies and its maintenance of virulence under unfavorable conditions are, I fear, not sufficiently appreciated. Animals and insects serve more to preserve the bacilli and spread them to accessible places than to transmit the disease directly. Infected merchandise is most important. The relative location of primary buboes in the lower classes points to the importance of infected dwellings, filth and merchandise.

All nations are susceptible. An apparent racial immunity depends on some national characteristics, most important of which are dress and cleanliness.

The cosmopolitan features of *Bacillus pestis* enables this organism to form endemic centers in any climate or city offering sufficient filth and ignorance. In ancient times many of the epidemics began in Egypt to spread along the shores of the Mediterranean to Asia Minor, Turkey and Europe. For many years Turkey furnished an endemic home, but as civilization advanced plague disappeared. Gradually the disease traveled through Asia Minor to Asia, China and India. Here the chief endemic centers are found. But are these localities all? Plague exists in many countries where it appears from year to year. Even San Francisco had a number of cases last year. May not such localities be temporary or permanent homes from which epidemics may spring? With occasional cases of plague in San Francisco, can we longer say that this disease cannot gain a foot-hold in our country? Does the Chinese District in San Francisco differ from similar districts in other lands? The presence of plague answers these questions.

The conditions in the Orient most favorable to the spread-

ing of plague may be discussed under the headings of the people, their cities and commerce. As China, especially Canton and Hong Kong, are of most interest and importance, the conditions there found will be given in some detail.

Generally speaking, oriental cities are old and substantially built in a style least favorable to hygienic measures. Accumulated filth in houses, yards and streets apparently has been unseen by passing generations.

Kwang-tung is one of the largest and wealthiest provinces in China. Its soil is fertile and well watered.

Canton, the capitol of Kwang-tung, is situated on the Pearl River about seventy miles north of Macao and ninety miles northwest of Hong Kong. It is in latitude 23° 7′ 10″ N., and longitude 113° 14′ 30″ E., about the same parallel as Havana. Its history dates from the second century B. C., when traders entered the city. The old city is surrounded by a high wall, about six miles in circumference; a partition wall divides the city into unequal districts. A moat used to surround the city. Several canals enter the city from the river. Through these the tide aids in cleaning the city. Its exact population is unknown; it is estimated at several millions, and steadily increasing. On account of its favorable geographical location, Canton has long been one of the most important commercial cities in China and to-day is perhaps the richest. The streets are crooked, narrow and usually paved with stone. Surface drainage is most frequent. The houses are substantially built, poorly ventilated, containing many interior rooms. In the foreign settlements many modern buildings may be seen.

The material characteristics of the Chinese vary greatly. According to our modern ideas these people are uneducated, especially as regards sanitation and diseases. Owing to overpopulation, competition is severe, allowing each but little more than the necessities of life, which in tropical and subtropical regions are but little more than food. Their food is purchased ready cooked from street venders, whose outfit consists of a small box, sometimes on wheels, in which an oil stove keeps a vegetable and meat soup hot. Almost any Chinese delicacy may be fished out of this pot. The outfit looks filthy and is usually kept by a lazy, filthy Chinaman who seems to care little for his business.

Their stores are usually small but well filled; a portion of the rear end is partitioned off for an office or residence. This back room is usually dark and filled to overflowing with all sorts of traps. If used as a residence one or more platforms as wide as a man is tall about eighteen inches apart, are placed one above another along one side of the room. The floor and each platform are used as beds, in which the Chinamen lie side by side with their feet toward the wall. In this manner a large number of people may live in one small, poorly ventilated room. The floors above the stores are used as residences or factories, or both. Here the same bunk arrangement may be seen. Usually the sleeping rooms are poorly kept and the amount of filth found is often astonishing, while the stench is frequently sickening. The number of individuals living in one small house is often astonishing; as many as one hundred and eighty have been found living in a house elsewhere occupied by a family of six or seven. During the day most, if not all, of these individuals go out for work. In the absence of an acute sense of cleanliness, the filth accumulating from such crowds must be great. The occupants seem to live with it and to like it.

In the absence of sewers and garbage carriers, filth rapidly accumulates in the yards and streets, where decaying vegetable and animal matter always exists. Often the stench is repulsive; in other places the hot sun retards decomposition by drying the decomposing matter. Their market places are often most vile. Thus the lower classes live, walk, sit and eat in filth. These conditions furnish food for rats, mice and insects, which exist in great numbers. As scavengers they are often a blessing. The organic matter furnishes media for bacteria of all kinds. Multitudes living under such conditions must be in a state of lowered resistance and susceptible to any disease introduced among them. As their national customs are in many respects similar in every city, but little choice is to be had regarding a more suitable habitation.

For economical reasons dwellings are used as work shops or factories. When through with their day's work the laborers clear a space on the floor for the night or lie close in rows on platforms built along the walls, high enough above the floor to allow an ordinary man to walk under. In these rooms all manufactured products come in intimate contact with Oriental filth which may be infected; in fact it is surprising that more infection is not carried. Much of the manufactured goods are in the form of fabrics, paper goods, toys, etc., which in turn are packed in straw or paper previously in contact with the same filth or which has served as the habitation and play house of rats, mice and insects.

Religious notions and superstitions of various kinds give to the ignorant natives many peculiar ideas regarding modern sanitary and hospital methods. A Chinese hospital is as dark as a dungeon. If the ward has windows they are tightly closed with boards. Usually a single door opens into the ward. Along either side is built a continuous platform about eighteen inches above the floor and somewhat wider than a man is tall. From a wire suspended about eight feet above the floor a curtain hangs in front of the platforms closing them from view and forming a narrow aisle along the center of the room. From these curtains partition curtains extend to the walls, dividing the platforms into a number of compartments. In these small, dark, poorly ventilated, unfurnished compartments, a form of private wards, the unfortunate patient exists until recovery or death sanctions his release. If light is needed a small glass tumbler three-fourths filled with oil, on which a small taper floats, is used. A more dismal conception of hospital architecture and sanitary measures would be difficult to imagine. Yet the majority of these people absolutely refuse treatment in our modern hospitals. In discussing these questions a prominent Chinaman once said to me, "You know we are not educated to your way of living, and you must not expect

too much of us until you teach us what to do and how to do it. We are willing to do the best we know." The dread of modern methods causes Chinamen in Hong Kong to conceal their sick until death when, because of the cost of burial, permits and disinfection, they are cast into the streets for the city authorities to bury. In the case of plague cadavers this practice is most dangerous, as the cadaver is teeming with plague bacilli. It is also impossible to ascertain in which house the case died. Because of the infectious character of the excreta and sputum, and the generally filthy condition of the people, a single case in a crowded house may serve to infect not only individuals living in the house but also may spread infection wherever its occupants may go. It is a favorite custom of the Chinese to collect in large numbers in certain places to talk over subjects of common interest, to gamble and to smoke their favorite pipe; here a few infected individuals may rapidly spread infection.

It may be said that wherever Chinamen locate in numbers a Chinese district is at once established, where all of their national customs are practiced. Here the same filthy, crowded condition exists.

Yet, with all his faults, some respect is due the Chinaman. He belongs to one of the oldest nations; he has been raised to hard work and honesty, and he conscientiously lives up to his religious ideas, whatever they are. In his ignorance his surroundings seem to him to be the best. If we judge him in the light of our own tenacity of the customs of our fathers, it would seem most unnatural to expect him to be willing to cast aside his traditions at our bidding. On the other hand, he is an intelligent individual, aspiring for success, and is usually willing to do whatever best promotes his progress. To us disinfection and light, comfortable hospitals are necessities; to him, they are unknown. As bacteriology in its lay sense is unknown to him, it is practically impossible to explain disinfection. After days of teaching, with demonstrations, the idea becomes in a measure clear to him. Then he is willing to take an active part in promoting sanitary measures. Unfortunately, too few of us are willing to take the necessary time and patience to teach them. It may be said that when their education is undertaken in the proper spirit Chinamen are anxious to know all we know, for they see our progress and have noted our encroachment on their territory. As an example of what may be done, I will cite the part taken by the Chinese in the epidemics of plague in Manila. When plague was discovered, the Chinese consul and a prominent merchant, Señor Palanca, representing the two Chinese factions in Manila, were asked to come to the office of the board of health. Here they were informed that plague was in the city and would most probably affect their countrymen and that the American authorities desired to help in every way possible to protect their people. Certain procedures were suggested. The two Chinamen listened to all that was said and asked for time to consider the matter. This conference resulted in the erection of a Chinese plague hospital, with Chinese doctors and attendants, and the organization of a corps of Chinese inspectors, who reported every morning to a member of the board of health the probable diagnosis of every sick Chinaman in the city. During the day an American physician with a Chinese interpreter visited the reported cases, which, if found to be plague, were removed to the hospital. Later the house with its contents was disinfected. Approached in this manner, these Chinamen saw that it was for their interest to help combat the disease with the best known methods. When asked for an autopsy, they said, if you insist, we cannot prevent; but if you make it, our people will no longer cooperate, as this practice is contrary to our religious beliefs. It is my belief that if Chinamen are understood and diplomatically handled, they can easily be influenced to improve their present hygienic methods, but if opposed they resist unto death. It seems to be a general idea among civilized races that Chinamen have no rights worthy of consideration. Naturally this is an unfortunate mistake, seen quicker by the Chinamen than realized by those coming in daily contact with the shrewd merchant of the Orient. Under false impressions that nothing can be done to prevent the disease, plague has been given a free berth and hand in the city of Canton with its millions of people. There the disease is said to be epidemic, increasing or decreasing, but always present. In a city of the population of Canton a large death rate resembles a clearance sale in a large department store; more space is given for new material. Absolutely no steps are taken to relieve the situation. Canton is in constant communication by land and water with its nearby seaport, Hong Kong. The voyage is made by water in a single night, and an individual may contract plague in Canton and develop the disease in Hong Kong, or an infection may be carried in merchandise, etc. Granting that Hong Kong could exterminate plague as rapidly as it is found, Canton would easily and surely reinfect the city as often as it had been disinfected.

Of all Oriental cities Hong Kong, on account of its enormous shipping interests, is by far the most important. Practically every steamer plying in Oriental waters touches at Hong Kong for coal, merchandise or passengers. There all freight, baggage and coal are handled by Chinese coolies, who, living in the filthiest portions of the city, are most exposed to infection. In addition to handling the freight these individuals when aboard a liner go wherever their fancy dictates. Rats also in large numbers often board the steamers. I have heard passengers say that while in Hong Kong rats came aboard in such numbers as to be a nuisance. From Hong Kong these steamers go to all ports in the world to discharge their cargoes of merchandise, rats and bubonic plague. With Canton as a plague supply depot and Hong Kong as a distributing point, it is not surprising that within the short space of a few years plague has been spread over the civilized world. But this is not all; granting that the civilized world could successfully combat plague, it would soon be reintroduced from Canton through Hong Kong. History shows that epidemics of plague continue from a few years to fifty or sixty years, and in endemic homes are always present. So we may infer that for the next fifty years at least

Canton may supply the world with plague infection. If all the population of Canton were destroyed by plague, the city could be repopulated in a day from the surrounding districts. Accustomed now to the death rate, ignorant as to its cause, there are millions upon millions of Chinamen anxious to take up city life as offering more lucrative employment than can be had in the country districts. Plague soil must remain fertile as long as millions of ignorant people live in the filthy overcrowded city.

Doubtless Hong Kong originally received its infection from Canton, but now the disease is continually present, often in epidemic form; to all intents Hong Kong is an endemic home.

Sufficient has already been said regarding plague in India.

The exact method of introduction of plague into Manila has not been determined. Whenever possible Chinamen often visit their home people. Consequently on every steamer plying between Manila and Hong Kong may be seen numerous Chinese passengers, who must land in Hong Kong to take small coasters or travel overland. While in Hong Kong these travelers stop in the Chinese quarters where plague infection abounds. On their return trip a second stay in Hong Kong is necessary. In this way and by merchandise, rats and the like, infection can easily be carried to Manila.

In Manila the conditions favoring the spreading of plague are about the same as they are in China. The people are poorly clothed and fed, crowded together in poorly constructed and illy ventilated houses and as ignorant as human beings could well be.

Impoverished by several years' war, foodstuffs are high and the natives must exist on almost nothing. Consequently their ability to resist disease must be reduced and they are susceptible to any infection introduced among them. Intimate intercourse between Manila and numerous neighboring towns and islands has long existed. Since the American occupation intercourse with Hong Kong has been greatly increased. During 1899 and 1900 quarantine in name only existed in Manila, a useless official inspection being practiced. Early in the summer of 1899, attention was called to the prevalence of plague in nearby ports and the possibility of introducing the disease, and also cholera, into the Philippines, but in his universal wisdom the Military Governor disapproved all recommendations. In December, 1899, plague was discovered in Manila.

Owing to an unguarded intercourse plague gradually spread to a number of the neighboring towns, but not to an alarming degree.

In brief, it may be said that in any country, in any climate, the conditions which most favor the spreading of plague are poverty, poor food and dwellings, and ignorance. Of these ignorance is perhaps most important. Nowhere are these conditions better filled than in the Orient.

PEMPHIGUS VEGETANS.

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The conception of pemphigus has undergone a marked change since the beginning of the century just past. At that time any condition of the skin characterized by a bullous eruption was included in the class of pemphigus. There was a leprotic pemphigus, a syphilitic pemphigus, a pemphigus the result of burns, a neurotic form, a form following the use of drugs, and so on. To such an extent did physicians "torture one poor word" that Martius[1] could enumerate in 1829 ninety-six varieties of the "disease." Gradually, however, the use of the word was discontinued in referring to cutaneous conditions where the etiology of the bullous eruption was known or seemed probable. Instead of describing leprotic and syphilitic pemphigus, it seemed more appropriate to speak of these eruptions as the bullous exanthems of leprosy and syphilis. The neurotic form came to find its place under the nervous maladies of the skin and in a similar manner a number of other varieties was classified. A contribution to this process of exclusion was added when Hebra defined erythema multiforme and thus eliminated a great group of cases from this chaotic collection. It is to this master, too, that we are indebted for the criteria, which determine, even at the present time, the classification of a bullous eruption under the caption of "pemphigus".[2]

Essentially a chronic disease of the skin and mucous membranes of unknown etiology, pemphigus is characterized by successive eruptions of bullæ with subjective symptoms, either absent or present, in varying degree, and offering a prognosis dependent upon the particular variety of the disease under consideration.

At present, four varieties of the disease are distinguished. The common form, pemphigus vulgaris, has been long recognized. Its firm bullæ, its tendency to recurrence and its doubtful prognosis are well known. The differentiation of the other three has been accomplished by the publica-

[1] Ueber d. Blasenausschlag oder Pemph., Berlin.

[2] Virchow, Handb. d. spec. Path. u. Therap., 1874, 2^te^ Auflage, Bd. III.

tion of a series of three papers which will be briefly mentioned.

In 1844, Cazenave[3] separated the variety which has since been repeatedly recognized and described under the title of pemphigus foliaceous. The flaccid blebs soon rupturing, the surrounding epithelium becomes detached. The epithelial exfoliation continuing, great areas of skin are denuded until, it may be, the whole body is flayed. The mucous membranes, hair and nails are in the meanwhile involved and the patient exhausted by sleeplessness, pain, fever and digestive disturbances succumbs.

In the years following Cazenave's publication many obscure examples of bullous eruptions were described. Each observer did not hesitate to suggest a name for the affection he reported and so there accumulated a confusing mass of material. In this group certain differences were apparent. One set was characterized by a bullous eruption, frequent involvement of the mucous membranes and slight disturbance of the cutaneous sensibility. These disorders ran a malignant course and were in some instances regarded as anomalous forms of syphilis.

A second group declared itself by the multiformity of its manifestations for, in addition to the characteristic bullous and vesicular efflorescences, other elementary lesions were represented. These cases showed remissions and recurrences and did not, as a rule, attack the mucous membranes. They were benign and accompanied by pruritus and paræsthesia. Recognizing these differences, Duhring[4] in 1884 separated this second group and created the dermatosis which bears his name.

No cutaneous disease has given rise to more lively debate than has Duhring's dermatitis herpetiformis. Its very right to a separate existence has been assailed by no less an authority than Kaposi[5] and its nosologic position has not yet been thoroughly settled. It may, however, be assumed that it is entitled to be regarded for the present as a clinical entity. The question is bound up in a consideration of the relation of the disease to other inflammatory conditions of the skin. Kaposi would have us regard dermatitis herpetiformis as a refuge in classifying atypical cases of erythema multiforme and pemphigus. So long as etiological, pathological and bacteriological criteria are wanting, the differential diagnosis must depend upon the clinical picture and the evolution of the disease. These are sufficient to differentiate dermatitis herpetiformis from erythema multiforme in a majority of instances. In the one the irregular distribution of the lesions and the striking subjective symptoms contrast strongly with the preference of erythema multiforme to attack the dorsum of the hands and feet and with the usual absence or mildness of itching and burning.

The relation of Duhring's dermatosis to pemphigus, however, is much more intimate. Indeed Duhring, himself, states that "The semblance in some, but by no means all cases to pemphigus naturally suggests a close relationship of the two diseases and that such exists in these cases there can be no doubt."[6] He reports a case in which the condition at one time would have been diagnosed pemphigus and which he subsequently classified as dermatitis herpetiformis because of the presence of peculiar vesicles, blebs, and pustules, in combination. Though it is unquestionable that the polymorphism, the herpetiform arrangement of the lesions and the subjective symptoms create a special place for Duhring's dermatosis, the intimate relation to pemphigus should, for the time being, be emphasized by considering it as a variety of this disease. The commoner types of pemphigus itself do not always present uniform pictures and though the characteristic lesion is a bulla, the bleb may rise from an erythematous base and wheals and pustules may be present. The eruption is occasionally grouped and subjective symptoms are at times prominent so that there are well recognized and generally accepted examples of chronic pemphigus which form connecting links between the common varieties and dermatitis herpetiformis. The modifying terms serpiginous, pruriginous, and gyrate, illustrate this transition. The future may provide an etiological basis for a more satisfactory classification but until then it seems advisable to group with pemphigus vulgaris and pemphigus foliaceous, Duhring's dermatitis herpetiformis.

The fourth variety of chronic pemphigus was defined by Neumann in 1886. It is from this form of the disease, pemphigus vegetans, that the patient whose history and condition will subsequently be recounted, suffered. The early history of this disease was referred to in sketching the origin of dermatitis herpetiformis. There, a certain class of bullous eruptions pursuing a malignant course was contrasted with a group of benign affections which Duhring embraced in the description of his dermatosis. It was also stated that they were sometimes regarded as varieties of syphilis and it may be added that this view continued to be held until Neumann recognized their connection with chronic pemphigus and published his opinion in the Vierteljahrschrift für Dermatologie und Syphilis in 1886.

Previously, under the title of Herpes vegetans, Auspitz[8] described what Neumann viewed as the affection under consideration. Moreover, as syphilis cutanea papillomaformis (vegetans) or framboesia syphilitica, Kaposi[9] reported a case likewise supposed to be of a similar nature. In none of these instances is the condition of the mucous membranes indicated. Besides, in the patients of Auspitz, the occurrence of pregnancy and the presence of syphilis in one of them, complicated the diagnosis. At the present moment

[3] Ann. des Maladies de la Peau et de la Syphilis, tome 1, p. 208.

[4] N. Y. Med. Jour., 1884, vol. 39, p. 562.

[5] Path. et Trait. d. Malad. d. la Peau (Traduction par Besnier et Doyon), 1891, tome 1, p. 839.

[6] Cutaneous Medicine, 1898, Part II, p. 447.

[7] Bd. xiii, S. 157.

[8] Arch. f. Derm. u. Syph., 1869, Bd. 1, S. 246.

[9] Ibid., S. 403.

the inclusion of both Auspitz and Kaposi's cases with pemphigus vegetans might be questioned. But there can be no doubt that Neumann had seen this form of pemphigus and had fallen into error. The patient whose condition he, as well as Hebra, regarded as luetic and whose case was published as such in 1876, was, he subsequently determined, a victim of pemphigus vegetans.

This patient was a lady thirty-one years old whom Politzer asked Neumann to see in January 1875. She was then complaining of great discomfort on swallowing. Her illness dated from the previous November when blebs appeared in the right axilla. Bursting, they left a raw moist surface on which granulations appeared. The mucous membrane of the lower lip, mouth, and fauces became affected so that the patient could take only liquid nourishment. The condyloma-like axillary vegetations led to a diagnosis of syphilis. Subsequently the vegetations appeared on the abdomen, in the groins, and over the labia majora. The various orificial mucosæ became affected.

The disease progressed steadily, other blebs, isolated and confluent, developing in the axillary region, on the chest, abdomen, and back. The exfoliation of the epidermis left raw surfaces like a burn of the second degree. There was considerable pain and the eruption exhaled a foul, almost unbearable odor. Uninfluenced by the remedies administered, the patient died, emaciated and exhausted, after an illness of four months' duration. The only comfort afforded the sufferer was the use of the full continued bath.

Before the patient died, it became evident that the condition was an independent affection uninfluenced by antisyphilitic treatment and in truth bore relation to the group of chronic pemphigus. Then Neumann recalled two previous instances in which the erroneous diagnosis of lues had been made and, together with six other examples, subsequently recognized and correctly interpreted, published his paper on the basis of these nine cases.

Almost simultaneously and independently Mr. Jonathan Hutchinson called attention to "A Form of chronic Inflammation of the Lips and Mouth which sometimes ends fatally and is usually attended by Disease of the Skin and Nails."[10] With his characteristic accuracy of observation and recording he gives an account of several cases of ulcerative stomatitis with and without cutaneous eruptions to which his attention had been directed during the previous ten years. He points out that a question might arise as to whether all of them are of the same nature, and from our present knowledge it seems more probable that they are not similar. Yet, in the first group he recites the histories of two cases of pemphigus vegetans without assigning, however, a name to the affection. But, in a few words he shows clearly its distinguishing features and makes a surmise as to its relation to pemphigus. "The cases are important," he writes, "on account of their severity and from their close resemblance in some instances to syphilis" and again in portraying the eruption he describes "bullæ like those of pemphigus." He adds, "When the bullæ broke, papillary excrescences sprouted up from their base." Though Mr. Hutchinson gives such a clear representation of the disease, nevertheless it is Neumann's paper that has led to a general recognition of pemphigus vegetans. The French give him due credit by calling the affection "Maladie de Neumann." The subsequent history of the disease is contained in the publication and discussion of about fifty cases from which a survey of its features may be made.

Pemphigus vegetans is not a common disorder. In this country, J. Nevins Hyde is the only observer to report a case.[11] It is a disease of adult life and spares neither sex. The patient is in good health until attacked and neither the family history nor the occurrence of a previous illness throws light on the etiology. Mr. Hutchinson comments on the fact that his patients were residents of the country. Statistics drawn from the recorded cases regarding the occupations and residences of sufferers from pemphigus vegetans, cannot be compiled, for the published details are too meagre, but it is rather interesting to note that our patient, as well as Danlos and Hudelo's[12] were both farmers. In the discussion of the latter case, Brocq mentioned that he had seen the disease in a peasant and that there were "apthous cows" on the farm. The interpretation of these facts must, for the present, be left undecided.

The disease usually commences with soreness in the throat and mouth. In the present instance tiny pin-head-sized vesicles could be detected on the dorsum of the tongue, but owing to local conditions of heat and moisture, the blebs here do not long retain their form. Therefore, an examination usually reveals the mucous membranes of the mouth and fauces more or less eroded and partially covered with a yellowish pellicle of macerated epithelium. Hoarseness, pointing to an involvement of the laryngeal mucosæ, was the earliest symptom in our patient. In Ludwig's patient the preputial sac and urethra were first affected.[13] The conjunctiva may suffer and it is said that even the vaginal portion of the uterus and the rectum have been attacked. The affection of the mouth and throat is usually misinterpreted and it is only when the characteristic bullous eruption makes its appearance that the true nature of the condition becomes manifest. Occasionally this eruption marks the inception of the disease followed later by involvement of the mucous membranes.

The interval between the onset of the stomatitis and the appearance of the bullæ is usually one of days or weeks, but exceptionally, as in one of Köbner's cases, two years passed between the oral affection and the appearance of condyloma-like growths in the groins.[14]

The evolution of the eruption could be readily traced in the present case. Here the earliest lesion was a vesicle,

[10] Med. Chir. Trans., 1887, vol. lxx, p. 421.

[11] Jour. of Cutan. and Genito-Urin. Dis., 1891, p. 412.

[12] Ann. de Derm. et de Syph., 1900, tome 1, p. 1156.

[13] Deut. Med. Wochenschr., 1897, S. 267.

[14] Deut. Arch. f. Kl. Med., 1894, Bd. 53, S. 61.

the smallest being about 2mm. in diameter. Enlarging, a bulla somewhat lax and pendulous, and attaining a diameter of 1.5 to 2 cm., was formed. On opening the bleb, a clear, transparent, straw-colored serum exuded. In from two to three days the bulla began to exhibit yellowish points at its most dependent portion. The area of opacity having increased, the serous contents of the bleb finally became purulent. At this stage there developed a red areola about the lesion. Soon the thin layer of epidermis enclosing the pus ruptured and there was thus disclosed a red, raw, weeping surface partially covered by the collapsed epidermal wall. The adjacent patches now became confluent and the epidermis of the surrounding skin was lifted up so that the process spread in all directions, forming large areas many centimeters in diameter, at the periphery of which a ledge of epidermis, 2 to 5 mms. in width, remained adherent. In other places the true skin was not exposed but came to be protected by the formation of a thick, yellowish brown crust which, too, was fringed by the attached edge of the remains of the original bulla. Here as in the previous condition, an inflammatory halo encircled the lesion, giving the whole an ecthymatous appearance. Whether this crust formed or the tender surface became exposed, the end process proved the same. The last vestige of the dead epidermis disappeared and from the denuded surface there sprang a grey papillary outgrowth to a height varying with the location. On the arms and abdomen, where there was little mechanical irritation, it was not prominent, but in the axillæ and groins and over the back, regions exposed to friction, the papillary vegetating, condyloma-like character of the lesion was strikingly illustrated.

The cutaneous lesions may attack any portion of the body surface but the perigenital, axillary, umbilical areas and the regions bordering on the orificial mucosæ are seats of predilection. Except in the groins, pemphigus vegetans does not tend to show a symmetrical distribution.

In three of Neumann's cases the nails were affected, blebs appeared at their roots, the nails were discolored and lifted from their base by granulation tissue and pus. In a fourth case recently reported all the nails were the seat of such changes.[15]

In the present instance a small bulla as well as the vegetations was examined microscopically. The early lesions exhibited the signs of inflammation without any specific characters. With the exception of the layer of columnar epithelium the entire epidermis took part in the formation of the bleb's wall. The corium was the seat of a round-celled infiltration. The vegetations consisted of hypertrophied papillæ with their covers of stratified epithelium and their dilated blood vessels. Leredde and likewise Gastou have found eosinophiles in great abundance in the cellular infiltration of the epidermis. Such was not the condition in the present case.

Our bacteriological studies have been of interest. Cultures from the bullæ showed only the staphylococcus pyogenes aureus; but from the mouth and it may be added, from the blood after death a bacillus belonging to the pseudo-diphtheria group was grown in pure culture. This organism presented a similarity to the pseudodiphtheria bacillus which Waelsch has twice isolated from recent blebs and from the blood of two patients suffering from pemphigus vegetans.[16] Both our organism and Waelsch's exhibited irregular staining properties and polymorphism and both were pathogenic for guinea-pigs. There are these differences, however. Our bacillus did not stain by Gram's method while Waelsch's did retain its coloring. We could rediscover the organism in the blood of the dead guinea-pigs but in Waelsch's animals, the blood was sterile. In neither series of observations were changes resembling those of pemphigus vegetans found.

Aside from the condition of the mucous membranes and skin, pemphigus vegetans has no characteristic symptoms or signs. Itching is not a prominent feature, but the excoriation causes much pain and burning.

Irregular attacks of fever may usher in fresh eruptions or may occur independently.

Albuminuria and gastro-intestinal disturbances are not infrequent.

Leredde[17] lays great stress on the occurrence of an eosinophilia. In his own cases, as well as in one of Neumann's and Danlos and Hudelo's, the eosinophilic cells were augmented; in the latter, to six per cent. We noted particularly that in our own cases no such increase in eosinophiles occurred. The absence of eosinophilia in the present instance is significant in view of Coe's observations on its prognostic import in pemphigus,[18] his suggestion being that the presence of eosinophilia may betoken a more favorable outlook.

Symptoms referable to the nervous system have been occasionally described. In three of Neumann's patients, the tendon reflexes were exaggerated and two of them suffered from muscular contractures in the extremities. In the third, there was in addition ptosis of the right eyelid. A muscular tremor has also been noted by Herxheimer.[19] The patient in our care, exhibited a certain mental sluggishness. While under observation, he was somewhat stuporous, responding to questions slowly and only after the lapse of a noticeable interval of time.

The course of pemphigus vegetans is marked by a steadily progressing cachexia in spite of periods of marked amelioration in the condition of the mucous membranes and skin. Indeed, the integument may assume an almost normal appearance and yet the sufferer may be separated from death by only a few days. Pneumonia, nephritis and intractable diarrhœa are the usual terminal events. The duration of the disease varies from a few weeks to fourteen months, usually less than a year. There are two reported exceptions to this statement. In both, the patients lived ten

[15] Ann. de Derm. et de Syph., 1901, tome ii, p. 869.

[16] Arch. f. Derm. u. Syph., 1889, Bd. 1, S. 71 and 78-100.

[17] Ann. de Derm. et de Syph., 1900, tome 1, p. 1161.

[18] American Medicine, June 28, 1902, p. 1092.

[19] Arch. f. Derm. u. Syph., 1896, Bd. 36, S. 141.

years after the inception of the affection. The first is the one seen by Neumann in Hebra's clinic and whose condition is briefly described and illustrated in Kaposi's [20] atlas. The other was reported by Köbner.[21]

It is the case of a man thirty-two years of age, who suffered in 1886 from blebs and ulcers over the mucous membranes of the cheeks and tongue. In 1888, condyloma-like growths uninfluenced by mercurial treatment were present in the gluteal region. For the next several years, the lesions in the mouth recurred. In 1890, the bullous eruption with papillary excrescences appeared in the groins. Treatment by curetting brought relief and he was said to be in good health in 1893. Two years later, the malady returned and death ensued after an illness of a year.

Thus it will be seen that the apparent recovery is only a respite, death is the ultimate result.

Post mortem no changes in the internal organs have thrown light on the nature of pemphigus vegetans. In one of Mr. Hutchinson's cases, a large lympho-sarcomatous tumor was found in front of the spine, imbedding the pancreas and large vessels. In our patient, a similar neoplasm was situated in the anterior mediastinum presumably having its origin in the thymus. In none of the other published autopsies were such tumors disclosed. The causal relation is, therefore, not evident, but it is proper that this coincidence between Mr. Hutchinson's case and the present one should be indicated.

The nervous structures have been repeatedly studied in the hope of throwing light on the origin and nature of the disease. Unfortunately, examination of the brain and cord of our patient was not permitted. The first, second, and third dorsal spinal ganglia were excised, however. They exhibited no gross alterations. Microscopically, the ganglion cells showed interesting changes, the chief of which consisted in a marked increase of pigment. Some cells were three-fourths occupied by the pigmented granules while many showed one-half the cytoplasm thus replaced. Others presented signs of degeneration in that the outline of the nucleus was wanting and the nucleolus had become indistinct. Marianelli [22] has also observed this hyperpigmentation in the cells of the upper cervical ganglia of the sympathetic, and degenerative changes similar to those just described but having their seat in the cells of the anterior cornua and Clarke's columns have been noted in a case of pemphigus vulgaris by Brochieri.[23] These alterations have probably no bearing on the causation of pemphigus vegetans; indeed, they are doubtless, as Köbner points out, secondarily dependent on the toxæmia of the disease.

It follows then that neither bacteriological nor pathological studies [24] have furnished means of identification and the diagnosis of the disease must rest on its clinical aspect and course. Fully developed, the affection has been most frequently mistaken for syphilis. "Though the patient's morals," writes Neumann, "were thus indicted, on the other hand, the hope of recovery was held out to him." [25] To be saved from such an error, the diagnosis becomes a matter of importance.

The elementary bullous eruption, should, when present, lead to a recognition of the pemphigoid nature of both the vegetations and the lesions of the mouth. If the blebs have been effaced, subsequent efflorescences alone or together with the stomatitis, should make the diagnosis clear. Aside from the bullæ, the superficial nature of the excoriations and certain characteristics of the vegetations serve to differentiate pemphigus vegetans from syphilis. The former grow rapidly and the remains of the bleb may be detected at the periphery of the vegetations; the border of a condyloma is firm and indurated. Neumann also calls attention to the stippled appearance of the vegetations as opposed to the uniform deposit which may cover a condyloma. Finally, the absence of a history of lues, the fact that other evidences of syphilis are wanting, and the injurious effect of antisyphilitic treatment, which was noted in our patient as well as in other of the recorded cases, these data contribute to establish the correct diagnosis of pemphigus.

Little need be added to what has already been said regarding the differentiation of the other members of the pemphigus group from pemphigus vegetans itself. It is well known that they may exhibit, at rare intervals, vegetating lesions. Indeed, in Grouven's case of pemphigus vegetans the lesions at the onset were those of the common and exfoliating types and only the subsequent course led to the diagnosis of pemphigus vegetans.[26] Hallopeau and Leredde [27] believe that the mode of development of pemphigus vulgaris, as well as of dermatitis herpetiformis, differentiates these disorders from Neumann's disease. Here they do not present the asymmetry of pemphigus vegetans. Neither does a single bulla, as in the latter disorder, by its eccentric extension, come to involve a considerable area of skin. Lastly, they point out the favorable influence of local treatment on the cutaneous manifestations of pemphigus vegetans as contrasted with its usual failure in dermatitis herpetiformis and pemphigus vulgaris.

There are a number of other dermatoses complicated by disease of the mucous membranes and vegetating lesions which have led to confusion with pemphigus vegetans. The disorder which Hallopeau regards as the pustular variety of Neumann's disease, should, in all probability, be set aside as a distinct condition. Its pustular character, the group-

[20] Die Syphilis d. Haut u. der angrenzenden Schleimhäute, 1875, III Lieferung, Tafel LXIII u. LXIV.

[21] Loc. cit.

[22] Giorn. ital. delle Malat. vener. e della Pella, 1889.

[23] Giorn. ital. delle Malat. vener. e della Pella, 1898, anno xxxiii, p. 371.

[24] For studies on the metabolism see Stüve, Arch. f. Derm. u. Syph., 1896, Bd. 36, S. 191, and Giovanni, Gior. ital. delle Malat. vener. e della Pella, anno 33, 1898, p. 354.

[25] Loc. cit.

[26] Arch. f. Derm. u. Syph., 1901, Bd. 55, S. 423.

[27] Traité pratique de Dermatologie, 1900, p. 734.

ing of the lesions and its more benign nature (only two of the five patients died) contrast with the essentially bullous character and the hopeless outlook of Neumann's disease. Tommasolli[28] has persistently insisted that the term "pemphigus vegetans" has been used to cover a multitude of conditions some of which have no evident relation to pemphigus. He has proposed to designate them all as condylomatosis pemphigoides maligna, thus abandoning the title of pemphigus vegetans. This procedure is not justifiable. On the other hand, there can be no doubt that as pemphigus vegetans at least two conditions have been on several occasions described and confused; the disease which Neumann distinguished and another to which Hallopeau's dermatosis belongs, a condition characterized by vegetations but where the bullous or vesicular lesion is absent or plays such an insignificant role that for the present it may be excluded from the pemphigus group.

The pustular character of impetigo herpetiformis, too, should differentiate it from pemphigus vegetans. The frequent association with pregnancy is an assistance in the diagnosis of impetigo herpetiformis as well as in the recognition of other cutaneous disorders occurring in this state.

Finally, the rare examples of drug eruptions, such as Hallopeau[29] describes as following the use of iodide of potassium though combining disease of the mucous membranes with cutaneous vegetations, may be distinguished by the attendant circumstances and the subsequent course.

We have now discussed the diagnosis of pemphigus vegetans when the disease is presented in its entirety. The superficial resemblance to syphilis has been emphasized. At the onset, with the lesions localized in the mouth and throat, a confusion with lues is likewise possible and the failure of antisyphilitic treatment or the appearance of the cutaneous efflorescence may first indicate the error in diagnosis. Seldom, however, does one see mucous patches so extensive as the initial stomatitis of this variety of pemphigus while occasionally, as in our patient, the occurrence of intact vesicles on the mucous membranes, raises a suspicion of the true nature of the disorder.

The unusual "epidemic stomatitis" or "foot and mouth disease," communicated by cattle, is also accompanied by a vesicular eruption in the mouth and fauces but the demonstration of the source of infection, the hemorrhagic tendency of the disease and its usually favorable course are guides to its recognition.

At rare intervals there are encountered in adults examples of severe stomatitis of unknown origin, such as Mr. Hutchinson has described in the paper to which we have referred. These bear, in all probability, no relation to pemphigus. The possibility of Neumann's disease should ever be held in mind and a careful and repeated search for the ill-omened bulla be made. Mr. Hutchinson's patients recovered under a treatment to be presently mentioned.

It may be gathered from the foregoing statements as to the grave nature of the disease that treatment is limited to assuaging the suffering of the patient. General medication is without effect. Arsenic is valueless, mercury and iodide of potassium are harmful. The efforts of Waelsch to develop a treatment based on a possible etiological factor are worthy of note. After isolating the pseudodiphtheria bacillus from his two cases and finding that diphtheria antitoxin apparently immunized animals, he was led to use the antitoxin on his second patient as a therapeutic measure. While the patient was receiving this treatment, the animals having survived forty to forty-four days, died, and it became clear that the protection was temporary or apparent. The attempt to obtain an antitoxin for the particular organism under consideration was now made, but the patient succumbed before the necessary material could be gathered.

Another therapeutic suggestion has come from Mr. Hutchinson. In those cases of severe stomatitis which bore a resemblance to the buccal disorder of Neumann's disease opium was administered and under its use the lesions healed. But, in no case of undoubted pemphigus vegetans, has opium been fairly tried at the beginning of the malady. One is therefore justified in exhibiting opium in any unusual case of stomatitis, even before a definite diagnosis is established.

Although nothing alters the fatal tendency of the disease, the cutaneous lesions are favorably influenced and the discomfort of the sufferer is greatly diminished by the continuous use of the full bath. Under this treatment, the excoriations over the back, neck and arms of our patient healed and there was obtained a degree of comfort which the previous applications of lotions, ointments and powders failed to give.

The state of the mouth necessitated the use of liquid and soft food while rinsing with a hydrogen peroxide wash was continued.

After all has been said, the nature of this malady remains obscure. The prevalent view is that the immediate cause is some infection or intoxication. Perhaps subsequent investigation may prove a causal relation between the pseudodiphtheria bacilli which Waelsch and we have isolated and place pemphigus vegetans in the category of infectious diseases. But, the disease is not contagious and in addition to a specific organism some predisposing factor must be assumed. With the presence of an eosinophilia in some cases as a basis, Leredde has suggested that a latent alteration in the hæmopoietic apparatus predisposes certain individuals to the immediate cause, whatever it may be. Such an hypothesis is extravagant. Analogy like that offered by the eosinophilia of trichinosis teaches that an increase in these cells is the result of an intoxication or infection and offers no evidence as to the previous state of the blood-forming organs.

History.

Mr. E. M., farmer, married, age fifty-two years, was admitted to the Johns Hopkins Hospital, in the service of Dr.

[28] Arch. f. Derm. u. Syph., 1898, Bd. 44, S. 329.
[29] Op. cit., p. 635.

Osler, February 6, 1901. He complained of a skin eruption and sore mouth.

Family History.—Mother died of "consumption." Father died of "stomach trouble." A sister died of "consumption." A sister is living and suffers from asthma. Four maternal aunts have died of "consumption." There is no history of new growths nor is there any account of a trouble similar to the present in the family.

Past History.—Measles and whooping cough as a child. At the age of twenty to twenty-five, he had a skin eruption which was said to be due to "poison oak." Subsequently he had several attacks.

At twenty-seven years, he was overcome by the heat; since then he has been susceptible to the sun's rays, having on several occasions suffered from vertigo after exposure.

Ten or twelve years ago, he had an eruption on the wrist; it itched and was pronounced eczema.

About five years ago he became nervous and weak and since then has not been able to do hard work.

He suffered from shaking chills two years ago.

Until four years ago, he chewed tobacco a great deal. He has never smoked to excess. He seldom drinks beer or whiskey.

He denies all venereal diseases.

Present illness began in January, 1900, with hoarseness. At about this time he suffered from a sore mouth. Little ulcers appeared on the lips, tongue and on the inner surface of the cheeks. They originated, he asserts, in little "blisters." Just before the onset of the sore mouth he had a scabby eruption on the legs which he attributed to "red bug bites."

In less than a month after the beginning of his illness an eruption commenced in the left groin. It was diagnosed eczema and under treatment apparently disappeared. Then a similar eruption appeared in the right groin; it itched a little. The same treatment was used but it was of no avail and the disorder reappeared in the left groin. It gradually grew worse and spread. It became so bad that the patient could not move about. The mouth and throat continued sore at intervals. In June, he commenced to expectorate a clear saliva which ran from the mouth night and day. In September, the disease was called syphilis and he was given the appropriate treatment by mouth and by inunctions. After this treatment the condition of the mouth grew worse, that of the groins seemed better. Two weeks ago yellow blisters appeared on the arms and the condition of the skin over the back grew worse. This eruption, the patient states, is entirely different from the "red bug bites" which were originally on the legs.

His general condition has become gradually worse. He has difficulty in chewing and swallowing. Bowels are regular. He has lost seventy-five to eighty pounds in the past twelve months.

Physical Examination.—The patient is a sparely nourished man. Mucous membranes are of fairly good color.

The patient is constantly expectorating a turbid, foul smelling tenacious sputum. The mouth presents a remarkable appearance. The vermilion of the lips is excoriated and irregularly covered by a whitish pellicle of macerated epithelium suggesting the mucous patches of syphilis. The tongue is covered with a yellowish white coating. Its dorsum is cracked and excoriated. Here and there on careful inspection tiny pin-head sized vesicles can be discovered. The mucous membranes of the lips, cheeks and fauces present the same white macerated and excoriated appearance just described.

With the exception of the palms, soles and scalp, no part of the body surface is entirely free from lesions. At the outer canthus of the right eye there is an excoriation about 1 cm. in diameter the edges of which are formed by overhanging epidermis suggesting the remains of a bulla. The surface is bathed with a purulent fluid. A dirty brown crust is situated over the lobule of the right ear and a foul smelling purulent discharge exudes from this external auditory meatus. The lips are covered with yellow honeycomb-like crusts. The right nostril is partly plugged by hard brown crusts and a discharge of pus comes from it.

Scattered over the neck, arms, axillæ, flexures of the elbows, forearms, back, abdomen, legs, and groins the lesions are distributed in various stages of evolution. The earliest change is evidently the formation of a vesicle or bulla. These lesions are present in the lumbar region, in the right axilla and flexure of the elbow and in the right groin. There are about one-half dozen of them. They vary in size from that of a lentil to that of a thumb-nail, are flaccid, discrete and the skin about them is unchanged. Here and there are bullæ of about the same size which have in their dependent portions a turbid yellow fluid.

The greater number of lesions are excoriations varying in size from about ½ to 8 cm. in diameter. They are discrete and confluent. Over the lumbar region they have come to form a large irregular patch about 20 by 10 cm. in size. The base of these excoriations is bright red and weeping; the border is formed by a ledge of epidermis. These characteristics are particularly well marked over the back. Some of the excoriations, as over the abdomen, are covered with large yellowish brown impetigo-like crusts and are surrounded by a red halo. Scattered among these lesions are tiny papulo-pustules evidently due to secondary infection.

The inguinal and perigenital regions are the seat of unusual changes. The groins are occupied by elevated greenish brown, foul-smelling excrescences about 10 by 20 cm. in diameter. The surface is crusted and cracked; closer inspection reveals its papillary character. The same lesion extends along the lateral aspect of the scrotum and posteriorly as far as the anus. Irregular patches of pigment are seen on the shins.

The nails of the left hand show deep transverse ridges about their centres.

The lungs exhibit the physical signs of emphysema; examination of the heart is negative. The abdominal exami-

nation is negative. The sputum does not contain the tubercle bacillus. The urine varies in specific gravity from 1010 to 1020, is acid, contains neither albumen nor sugar and does not give the diazo reaction. Microscopically, the sediment shows large sheets of epithelium.

Examination of the fæces yielded no noteworthy results.

The blood: hæmoglobin, 85%. Red blood corpuscles, 4,212,000. White blood corpuscles, 13,500.

Treatment and Progress of the Condition.

The patient was given soft and liquid food and Fowler's solution m. vi, was administered three times a day. About two weeks after admission to the hospital, he was placed in a tub bath. While under this treatment, the condition of the skin showed an improvement although fresh lesions appeared from time to time. Thus, the left eyelid became involved, there was a profuse purulent conjunctivitis but eventually these signs disappeared. From practically all the excoriations pigmented papillary excrescences developed as the healing process took place. About the neck and over the upper half of the sternal region, parts not covered by the water, the excoriations failed to heal. The papillary growths in the groins were not so prominent.

The condition of the mouth and throat varied from time to time, but on the whole became more and more involved so that even the swallowing of liquids caused great pain.

The temperature was elevated and irregular, ranging, as a rule, from 99° to 99.7°, only on two occasions going above 102°.

The patient lost weight continually, became very much emaciated, his mind wandered, the signs of a broncho-pneumonia developed on March 10, 1901, and he passed away the following day after an illness of about fourteen months.

Autopsy.

The privilege of investigating the brain and spinal cord was withheld. The autopsy confirmed the diagnosis of of broncho-pneumonia and emphysema. The condition of the spinal ganglia has already been noted.

In the anterior mediastinum there was a firm nodular yellowish white mass firmly adherent to the pericardium. It measured 18.5 by 7 cm. On section, the tumor was firm and gritty. It was found to be lobulated and composed of a translucent pale pink tissue striated with fine white lines. Microscopically, it consisted of irregular masses of tissue containing nuclei closely packed together and separated by compact strands, often rounded columns of dense fibrous tissue relatively poor in fibroblasts. The former tissue cells possessed nuclei either of the lymphoid or fibrous tissue type.

With the exception of the skin and lungs all other organs were normal. There was no ulceration in the gastro-intestinal tract or in the bladder.

Bacteriology.

Cultures taken from the blebs are either negative or show the presence of the staphylococcus aureus. Cultures from the mouth reveal the presence of a small bacillus in almost pure culture. In bouillon media it occurs in chains and groups of two. It is not motile, stains irregularly, particularly with Neisser's reagent. There are a number of irregular forms. It does not stain by Gram's method.

On agar it forms a moist, greyish white film with abrupt finely serrated edges.

Gelatine is not liquified.

No gas is formed in glucose agar.

On potato the growth has a faint yellowish hue and is moist.

In bouillon there is a heavy flocculent sediment with white particles in suspension.

Litmus milk shows no change at the end of twenty-four hours but in forty-eight hours it is paler but not coagulated.

The indol reaction is not given.

On October 8, 1901, both a guinea-pig and a rabbit were inoculated subcutaneously with a sixteen hour bouillon culture of the organism. The former received fifteen minims, the latter twenty-five minims.

The rabbit at the time of inoculation weighed 850 grms. It steadily lost flesh after the injection; on October 26, eighteen days after its inoculation, it died, weighing 620 grms. At autopsy nothing abnormal was found except slight congestion of the kidneys, spleen and liver. Cultures were taken from the heart's blood and a pure culture of the organism injected previously was obtained.

The guinea-pig weighed 230 grms. on October 8; it too lost flesh steadily and succumbed on November 1, twenty-four days after inoculation, having lost eighty grms. On section nothing abnormal was found. Cultures were taken from all the organs. From the heart's blood the original organism was isolated in pure culture.

The organs of these animals were carefully examined microscopically but no lesions were demonstrable.

The organism we were dealing with, no doubt belongs to the pseudodiphtheria group.

After the death of our patient, the micrococcus lanceolatus was isolated from the lungs; a pseudodiphtheria bacillus, from the blood.

THE JOHNS HOPKINS HOSPITAL BULLETIN.

The Hospital Bulletin contains details of hospital and dispensary practice, abstracts of papers read, and other proceedings of the Medical Society of the Hospital, reports of lectures, and other matters of general interest in connection with the work of the Hospital. It is issued monthly.

Volume XIII is now completed. The subscription price is $1.00 per year. The set of thirteen volumes will be sold for $32.00.

FIG. 1.—The prominent vegetations in the groin are here depicted. Two of the impetigo-like crusts are seen on the abdomen.

FIG. 2.—The illustration shows lesions on the back. Most of them are excoriations, about the borders of many the remains of the vesicle can be seen. One of the large crusts can be seen in the infrascapular region on the left side.

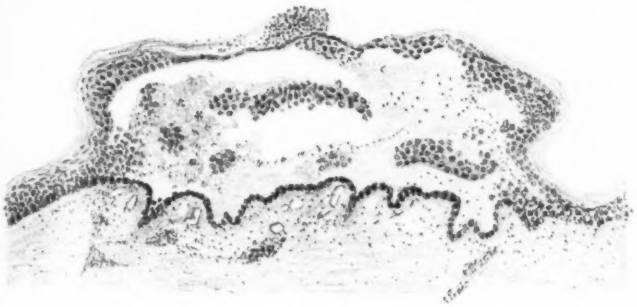

FIG. 3.—Represents the earliest lesion described, the vesicle. It will be seen that serum has accumulated in the stratum mucosum and has lifted up the greater part of that layer, leaving the columnar cell layer still attached to the corium. Here and there groups of polygonal cells have also remained adherent to the true skin.

The portion of the epidermis forming the walls of the vesicle is thinnest at the summit of the bleb, where it is made up of but two layers of flattened cells; from this point toward the margin the layers become more numerous until the entire normal thickness is reached.

Great numbers of leucocytes, especially the polymorphonuclear, are seen both within the vesicle and upon its surface. The contents of the bleb consist mostly of serum, leucocytes and epithelial cells in various stages of degeneration.

In the framework of the corium, especially about the blood vessels, there is marked round-cell infiltration, but here and there are groups of neutrophiles. In almost every papilla two or three dilated capillaries are found distended with blood.

FIG. 5.—This represents one of the papillæ magnified. Here the loose structure of the stroma is clearly seen. Here and there scattered in the connective tissue are white blood corpuscles, for the most part polymorphonuclears.

An enlarged capillary filled with blood extends the whole length of the papilla and occupies about one-fourth of its entire width. One or two layers of columnar cells are seen on the surface.

FIG. 4.—Represents the lesion at its most advanced stage and yet, it illustrates, too, many of the stages described in the clinical advancement of the disease.

Beginning at the left we see where the epidermis is lifted off from the papillæ (a), forming a shelf of epidermis (g). This is the remains of the covering of the vesicle. At its attached portion, to the extreme left, it approaches closely normal skin, but it gradually becomes more lifeless in appearance towards its free end until it is finally just a mass of necrotic cells at the point where the rupture has occurred.

Between this ledge and the papillæ of the corium are some of the remains of the vesicle contents plus the exudate from the papillæ. Here we find masses of necrotic epithelium, and great aggregations of leucocytes (e) floating in serum (f).

The papillæ at the margin of the lesion are increased in number and are higher and more irregular than normal. Here they are covered by usually one, but in many places several, layers of stratified epithelium that were left behind when the upper layers of epithelium were raised to form the vesicle.

The stroma of these papillæ is made up of very loosely arranged connective tissue in which many leucocytes that have wandered out from the vessels are seen. In almost every papilla are found one or more dilated capillaries filled with blood. (See Fig. 3.)

These vessels are extremely close to the surface, and so the weeping, red, raw appearance of the lesion is readily explained.

As the lesion becomes older the papillæ increase in size and become covered with many layers of stratified epithelium which has developed, no doubt, from the cells left behind in the formation of the original vesicle. It can readily be seen that this tremendous increase in the size of the papillæ accompanied by the hyperplasia of the epithelium would give the condylomatous, vegetating appearance described in the clinical picture. In these large papillæ the capillary dilatations are no longer so evident, but the stroma is still loosely arranged and shows a fibrillary structure.

In the connective tissue framework and about the blood vessels of the corium are great numbers of round cells (d).

THE TASTE FIBRES AND THEIR INDEPENDENCE OF THE N. TRIGEMINUS.

DEDUCTIONS FROM THIRTEEN CASES OF GASSERIAN GANGLION EXTIRPATION.[1]

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Were it a subject which lends itself readily to methods of experimental research the course of the taste fibres from their special sense terminals to the medulla would long since have been established. Unfortunately, the solution of this mooted question has hinged largely upon the study of clinical cases in which as a result of morbid processes or of traumatism, paralyses have involved, singly, one or another of the nerves supposed to carry these centripetal impulses. Owing to the rare possibility of an accurate determination of so slight an intracranial lesion, at or near the time when the examination for taste has been made, the interpretations have been so conflicting that impartial observers have been led to believe that there is considerable individual variation in the course of these fibres, especially centrad to the Ganglion geniculatum. On purely anatomical grounds such a variation would seem improbable, and if untrue, is to be regretted, since the symptom of ageusia may be of considerable moment in the diagnosis and localization of intracranial processes.

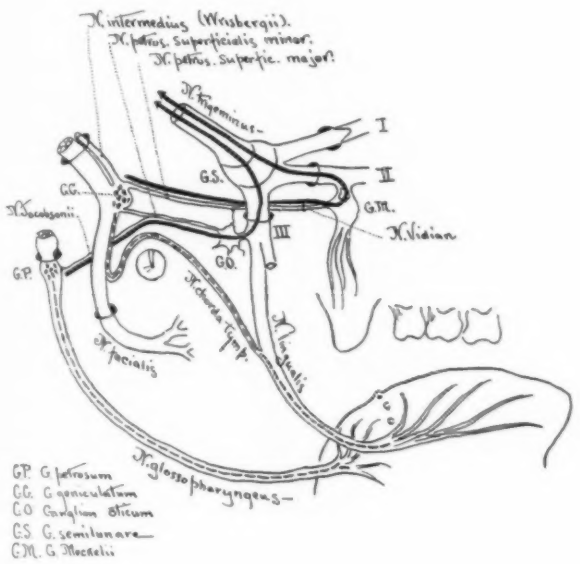

FIG. 1.—Diagram of the nerves commonly advocated as routes for taste transmission. Undoubted paths from tongue to G. petrosum and G. geniculatum are indicated by broken lines. Commonly advocated paths via the N. trigeminus to the brain indicated by heavy black lines with arrows.

Opinion is almost unanimous concerning the path traversed by the impulses from the anterior two-thirds of the tongue for a certain distance. As the diagram (Fig. 1) shows, they accompany the lingual nerve to its bifurcation; thence they pass by the Chorda tympani to enter the aqueduct of Fallopius, and from this point in company with the N. facialis to the geniculate ganglion.

How the fibres reach the brain in their further progression is undetermined. The chief weight of authority favors a most circuitous route by the great superficial petrosal and Vidian nerves to Meckel's ganglion, thence to the superior maxillary division of the trigeminal nerve, the ganglion of Gasser and to the brain by the N. trigeminus itself.

Another possibility, which morphological studies seem to favor, is a more direct course by way of the N. intermedius (Wrisburg) in company with the facial. It is, however, commonly stated, although the evidence seems rather circumstantial, that a pure intracranial lesion of the N. facialis (the portio intermidia presumably being included) is unaccompanied by any impairment in the perception of taste; and this is one of the chief arguments adduced in favor of the view that the N. trigeminus harbors the paths for these fibres. A similar intracranial lesion of the N. glossopharyngeus, which nerve undoubtedly conveys sensations of taste from the posterior third of the tongue and possibly from the palate (?), fauces and epiglottis as well, is also said to be unassociated with loss of taste over this territory, and the fibres from this region have, in consequence, been accredited by many with a correspondingly devious course to the N. trigeminus by way of Jacobson's nerve to the lesser superficial petrosal, Otic ganglion and mandibular or IIId division of the fifth nerve.[2] (Cf. Fig. 1.)

[1] Presented at the meeting of the American Physiological Society held in Washington, December 31, 1902.

[2] It would carry one too far afield and out of the province of this paper to discuss the numerous paths which, according to the views of one or another, are supposed to be followed by the gustatory impulses. Some of the more strongly supported claims are the following:

Fibres from the anterior portion of the tongue are supposed to pass by the devious route mentioned in the text to the IId division of the Vth nerve, (Erb, Schiff, Gowers, *et al.*); to the IIId division of the same nerve via the Otic ganglion (Ziel, Müller, *et al.*)

Fibres from the entire half of the tongue, anterior and posterior, pass to the brain by the Vth nerve, the glossopharyngeal fibres reaching the lesser superficial petrosal Otic ganglion and the IIId division of the Vth via the delicate nerve of Jacobson as described (Gowers, Turner, *et al.*)

Detailed reports of cases of cranial nerve lesions with partial or complete paralysis of the N. trigeminus accompanied by loss of taste on the corresponding side of the tongue have appeared in medical literature in considerable number during the past twenty years. The cases reported by Erb,[3] Gowers,[4] Salomonsohn,[5] Scheier,[6] Schmidt,[7] Ziehl[8] and Kron[9] may be mentioned among some of the more important and carefully studied clinical cases of this sort. In all of them the authors were led to the view that the taste fibres must pass to the brain in whole or in part by way of the fifth nerve. Although there are a few recorded cases such as those of Lussana and Renzi, of Lehmann,[10] Cassirer[11] and of Bruns[12] which contrariwise seem equally convincing, clinical experience on the whole seems to favor the trigeminal route of transmission. In very few, if any, of these cases, however, has it been possible to demonstrate by a post-mortem examination the isolarity of the lesion,[13] and the strongest advocates of this view acknowledge, as does Turner,[14] that the evidence derived from them leads to confusion as to the particular branch of the Vth which contains the taste fibres, whether the N. maxillaris or N. mandibularis.

It would seem that the established operation for removal of the Gasserian ganglion in cases of trigeminal neuralgia, or simply the intracranial section of the second and third divisions of the N. trigeminus, would be the equivalent in man of an accurate physiological experiment and would long since have determined with finality the part which the fifth nerve plays in the transmission of gustatory sensations. Curiously enough, however, the results of observations upon these operated cases heretofore have only led to greater confusion, owing to their apparent lack of uniformity. The evolution of the operation since the earlier unsatisfactory attempts at extirpation has at the present time rendered it possible in most cases to remove the ganglion in toto with inconsiderable difficulty, and several surgeons of experience have published their personal series of cases. Although largely reported from a surgical standpoint to the neglect of post-operative observations concerning the resultant paralyses, nevertheless some of these papers are not silent on the subject in question.

First of all Krause, in the six cases examined and reported in his classical monograph,[15] seems to have had variable results, although in no instance was there a complete abolition of taste perception. In one case on the 20th day "sweet" was the only form of taste recognizable and that tardily in comparison with the normal side. In other instances, taste although present to all forms of stimuli was diminished in acuity. In one case there was absolutely no alteration whatever. This positive finding he regards as

Fibres for the entire half of the tongue may ultimately pass by way of the glossopharyngeal through anastomoses between the Chorda tympani and Jacobson's nerve. (Cassirer, Carl, Brücke and Hermann, *et al.*) Observations made upon cases of middle ear disease are claimed to evidence passage of fibres by way of the Plexus tympanicus.

All fibres pass direct to the brain by way of the Portio intermedia (Lussana, Dixon), et cetera, et cetera.

It can be seen that impulses are supposed to travel in one direction or the other along the N. superfic. petros. major and minor and the N. Jacobsonii according as the reporters have found such a course necessary to conform with the supposed demands of the particular clinical picture. The embryological development of the nerves as indicated by His should show in what direction the impulses really pass. Dixon alone has touched upon this point. For an earlier discussion of the question see v. Vintschgau's chapter in Hermann's Handbuch der Physiologie, vol. iii, Zweiter Theil, 1880, p. 164, III. Die Geschmacksnerven. Also later, cf. v. Frankl-Hochwart, Die nervösen Erkrankungen des Geschmacks u. s. w., Wien, 1898.

[3] Erb, Ueber den Weg der geschmackvermittelnden Chordafasern zum Gehirn. Neurologisches Centralblatt, 1882, Bd. i, s. 73, s. 104.

[4] Gowers, A case of Loss of Taste from Disease of the Fifth Nerve. Journal of Physiology, 1880, vol. iii, p. 229. Also Diseases of the Nervous System, ed. II, vol. 2, p. 224, "Affections of Taste."

[5] Salomonsohn, Ueber den Weg der "Geschmacksfasern" zum Gehirn. Inaugural-Dissertation. Berlin. März, 1888. Ref. Neurolog. Centralbl., 1888, Bd. vii, s. 295.

[6] Scheier, Beitrag Zur Kenntniss der Geschmacksinnervation, u. s. w. Zeitschrift für klin. Med., 1895, Bd. 28, p. 441.

[7] Schmidt, Ein Fall vollständig isolierter Trigeminuslähmung. Deutsche Zeitschrift für Nervenheilkunde. Bd. vi, s. 438.

[8] Ziehl, Ein Fall von isolierter Lähmung des ganzen dritten Trigeminusastes, etc. Virchow's Archiv, 1889, Bd. cxvii, p. 52, and 1889, Bd. cxxx, s. 528.

[9] Kron, Ein Beitrag zur Lehre über den Verlauf der Geschmacksfasern, Neurologisches Centralblatt, 1901, Bd. xx, s. 549.

[10] Lehmann, Ein Beitrag zur Lehre vom Geschmacksinn. Pflüger's Archiv für Physiologie, 1884, vol. xxxiii, p. 194. A case of traumatic lesion of the VII, VIII, IX and XII nerves with complete loss of taste on corresponding side of tongue.

[11] Cassirer, Ein Fall von multipler Hirnnervenlähmung. Zugleich als Beitrag zur Lehre von der Geschmacksinnervation. Archiv f. Anat. u. Physiol., 1890. Supplement-Band, s. 36. A traumatic case of paralysis of the IX, X, XI and XII nerves with complete loss of taste on the corresponding half of the tongue. The uncertainty of deductions from clinical cases well evidenced by the author's excellent historical presentation.

[12] L. Bruns, Multiple Hirnnervenläsion nach Basisfractur. Archiv für Psychiatrie, 1889, Bd. xx, s. 495. Bruns' case is doubly striking inasmuch as there was a complete paralysis of the Vth nerve on one side without loss of taste and a lesion of the VII nerve on the opposite side associated with symptoms of ageusia.

[13] One of the cases on which considerable stress is laid in the English literature as bringing convincing evidence of these views is that reported by Ferguson (The Nerve Supply of the Sense of Taste. Medical News, Phila., 1890, vol. 57, p. 395).

Gowers, Turner and Stewart quote this case as furnishing conclusive support to their belief. Ferguson examined post-mortem a patient in whom loss of taste, lasting over a period of 18 months, had previously been demonstrated on one side of the tongue. A small exostosis was found compressing the Vidian nerve and the reporter claims to have demonstrated degeneration of the nerve passing from the point of compression into the superficial petrosal, facial, chorda tympani, and lingual nerves. No mention is made of any histological demonstration of evidence of degeneration nor are the methods of studying what must have been a most difficult and arduous problem, even suggested. In view therefore of the isolarity of this case and of morphological studies which show that the superficial petrosal is an outshoot of the G. geniculatum, the observation hardly deserves the keystone position which it has been given.

[14] W. A. Turner, Allbutt's System of Medicine, 1899, vol. vi, p. 793.

[15] Die Neuralgie des Trigeminus, Leipzig, 1896. Geschmacksempfindung, p. 82.

more important than all others and it is interpreted as an indication that the trigeminus possesses no taste fibres.

The information gained from other cases has been regarded as similarly inconclusive. Those of Tiffany,[16] Finney[17] and Lynn Thomas[18] are often quoted and, like Krause's, used as an argument pro or con indiscriminately by those ranged on both sides of the question.

Taste was examined by Dr. Thomas in two of Finney's cases and found to be absent in one and present in the other. In Tiffany's series also taste was absent in one case, present in another (4 months after operation) and uncertain in a third.

In two of the cases reported by Friedrich[19] examination showed a complete post-operative anæsthesia, analgesia and ageusia over the anterior two-thirds of the tongue. Taste before the operation had been examined and found to be normal. Köster in his recent admirable paper[20] published two years after Friedrich's report says that in one of these cases taste had completely returned to a condition equal to that on the normal half of the tongue. Anæsthesia to other forms of sensation still persisted. Believing as he does in the Vth nerve route of transmission from the "Chordagebiet" he accounts for this return of taste by the establishment of a collateral innervation on the side of the IXth nerve.

In the cases reported by Keen, Horsley, Lexer and others, all of whom have had a wide experience with the ganglion operation, the strictly surgical aspect of the extirpation is dwelt upon rather than its post-operative physiological sequelæ. Sir Victor Horsley is credited by Gowers with the statement that in the private cases operated upon by himself in which he afterwards tested the sense of taste he found it lost in each instance.

It is noteworthy that Sherrington[21] has experimentally made intracranial section of the trigeminal nerve and in one of his classical papers says that in the monkey, after section of the fifth cranial nerve, he has always failed to find evidence of persistence of any sense of taste in front of a line a few millimeters anterior to the circumvallate papillæ. Experimental observations with similar results were made by Schiff after removal of the ganglion in dogs.

[16] Tiffany, Intracranial Neurectomy and Removal of the Gasserian Ganglion. Annals of Surgery, 1894, Bd. 19, p. 47.

[17] Finney and Thomas, Three Cases of Removal of the Gasserian Ganglion. Johns Hopkins Hospital Bulletin, 1893, vol. iv, p. 91.

[18] Lynn Thomas, Notes on Two Recent Operations upon the Gasserian Ganglion. British Medical Journal, 1899, vol. ii, p. 1080.

[19] P. L. Friedrich, Krankengeschichten und Heilungsausgange nach Resection u. Extirpation des Ganglion Gasseri, etc. Deutsche Zeitschrift für Chir., Bd. 52.

[20] Georg Köster, Klinischer und Experimenteller Beitrag zur Lehre von der Lähmung des Nervus facialis, zugleich ein Beitrag zur Physiologie des Geschmackes, der Schweiss-Speichel- und Thränenabsonderung. Deutsches Archiv für klin. Med., 1900, Bd. 68, p. 342.

[21] Sherrington, Examination of the Peripheral Distribution of the Fibres of the Posterior Roots of some Spinal Nerves. Philosoph. Transactions of the Royal Society, London, 1898. Series B, vol. 190, p. 56.

It is no matter for surprise that those who have had the opportunity of studying cases after extirpation of the Gasserian ganglion in man have satisfied themselves with occasional or indeed isolated tests relative to the preservation or loss of the sense of taste. The observations are tedious, difficult both in performance and interpretation and like the study of other sensory phenomena are quickly a source of fatigue to the patient. There are, furthermore, so many other demands for post-operative notes upon these patients that unless especial attention is given to one particular point, it is apt to be superficially gone over.

Sir Wm. Gowers[22] in a recent article gives the only report of observations on the long series of cases which have been operated upon by Horsley and Ballance. Seemingly only five of these cases have been critically examined for taste, and according to Gowers' report in only one of them was it not abolished. Its preservation in this particular case is accounted for by the fact that the extirpation was supposed to be an incomplete one, for though taste perception was found to be present soon after the neurectomy, it subsequently disappeared. The examinations were made in these cases ten weeks, nine months, five weeks and four weeks respectively after the operation, and the statement is made that there was complete unilateral loss of taste *on the front and back of the tongue* in each instance. Owing to these observations, as well as to his earlier experience in cases of disease involving the Vth nerve, with accompanying loss of taste, Gowers champions almost without reservation the transmission of these impulses by way of the N. trigeminus not only from the Chorda territory on the front of the tongue, but from that part as well which is presided over by the N. glossopharyngeus.

Purves Stewart in a recent excellent text-book[23] expresses the matter in these words, * * * "it is highly probable that all the taste fibres enter the brain through the Gasserian ganglion, for when the fifth nerve is divided by operation in man, above the Gasserian ganglion, although the glossopharyngeal nerve remains untouched, there is total loss of taste on the whole of the affected side."

The writer's observations, which have covered a larger number of cases and which have given practically uniform results, are completely at variance with Gowers' findings and with this opinion as expressed by Stewart. In the first place, disturbances on the portion of the tongue presided over by the N. glosso-pharyngæus as the result of ganglion extirpation may be dismissed with a word. No interference whatever with taste perception posterior to the circumvallate papillæ has ever been observed, nor can I find that this has been the experience of others.

Gowers mentions as a possible source of fallacy from early observations after ganglion extirpation that taste may seemingly be preserved for a time owing to a terminal communi-

[22] Gowers, Taste and the Fifth Nerve, The Journal of Physiology, vol. xxviii, July, 1902, p. 300.

[23] A Manual of Medicine, Allchin, vol. iii (Diseases of the Nervous System), 1901, p. 234.

cation between the branches of the two sides and that impulses may reach the brain from the paralyzed side by way of median communications of this sort which subsequently may undergo atrophy.[24] Hence, he believes, that there is a possibility of early transmission of taste perception with its subsequent disappearance. The series of cases the results of which I shall report seem to indicate quite a contrary state of things, namely an early disappearance or partial disappearance of taste perception in a large proportion of cases with a subsequent return in large part of the same. It seems improbable also, should these impulses pass through such median communications, that localization of taste would be as perfect as it has been found to be and also improbable that such communications would pass to the outer border of the tongue where taste usually remains acute. Inasmuch as not all of my cases have been examined for late disappearance (months or years after the operation) of taste, the possibility of such a sequel must be granted, but should the sense be found absent I would be inclined to account for its loss by an implication of the fibres of the chorda tympani in late degenerative processes which have taken place in the N. lingualis.

In my own series of thirteen cases the precaution has been taken, whenever the patient's condition allowed of such observations, to make thorough tests for taste perception before the operation in order to establish in a certain degree the patient's personal equation. In this way it has been possible in a measure to train the patient in the recognition of taste sensations, especially those originating from the anterior part of the tongue. Such recognition for many individuals is a difficult matter and only by preliminary training has it been possible to overcome this obstacle to the examinations and also to eliminate in a certain degree the confusion which arises after the operation, owing to the presence of anæsthesia to other forms of sensation in the part of the tongue with which we are chiefly concerned. One of my earlier patients, for example, found it impossible to identify with certainty any of the primary taste qualities anterior to the circumvallate papillæ on either side of the tongue either before or after the operation. In a later case a similar uncertainty was gradually overcome by training, and after several trials the patient learned to identify promptly the four taste qualities. In this particular case after the operation the patient insisted that he tasted "plainer" on the anæsthetic side than on the other after removal of the ganglion. It is to be remembered that Vintschgau long since called attention to the great individual variation in "Geschmacksfähigkeit."

As a rule, in all of my later cases, tests have been made for the four primary forms of taste sensation—sweet, sour, bitter and saline—not only on the anterior and posterior portions of the tongue but also on the palate. Subsequent to the operation, as frequent tests have been made as circumstances allowed, during the patient's hospital residence, and these serial observations have brought out the fact mentioned above that in many cases at least there is a temporary diminution in acuity, or even a complete disappearance of the sense of taste over the anterior two-thirds of the tongue which endures for a variable number of days after the operation. In my first case alone did I fail to establish this final return of taste perception. One isolated observation was made on this patient six days after the operation, at which time it was noted that there was a complete absence of taste anteriorly on the operated side. As will be emphasized later, the same observation would have been made on the majority of the succeeding cases had reliance been placed on the truth of a single test made at a corresponding time after the extirpation.

It may not be out of place in this connection to state, lest there be some query as to the completeness of the operation, that the extirpation in all of these cases, with the exception of two, has been a total one, and that the ganglion with the intracranial stumps of all three divisions and the sensory root has been removed in its entirety and in a state of preservation in most cases sufficient for photographic reproduction. The two cases referred to, owing to operative difficulties were of necessity incomplete extirpations, the lower two-thirds of the ganglion only being with certainty excised. In both cases, however, the second and third divisions were removed with the neighboring portion of ganglion and the completeness of the intrabuccal areas of anæsthesia in these cases make them to all purposes as valuable for observations upon taste as if the entire ganglion, as in the other eleven cases, had been taken away.[25]

The area of post-operative intrabuccal anæsthesia is shown in the accompanying sketch (Fig. 2) and represents with but slight modification the areas mapped out in all of my cases. The territories correspond very well with those found by Sherrington to be present after experimental division of the trigeminal nerve in monkeys. Although the large part of this territory of anæsthesia should remain absolutely and permanently unchanged, careful examination of the tongue will show that in a certain percentage of cases the anæsthesia does not persist in its absoluteness. In several of my cases I have found after some days and in association with the return of taste, that certain forms of stimuli, such as the

[24] It is noteworthy that Zander has shown by methods of dissection that there is anatomically a slight macroscopical overlapping of the lingual nerve for some mm. across the median line. Ueber das Verbreitungsbiet der Gefühls und Geschmacksnerven in der Zungenschleimhaut. Anatomischer Anzieger. Bd. xiv, s. 131. Such an overlapping, as far as physiological activities are concerned, is hardly, if at all, demonstrable by methods of examination with the æsthesiometer after trigeminal neurectomy.

[25] The operation in all instances has been performed by the procedure described in the Journal of the American Medical Assoc., 1900, vol. xxxiv, p. 1035. Inasmuch as the method necessitates the preservation of the middle meningeal artery, the manipulations of freeing the ganglion are confined to a situation far enough anterior to render the likelihood of injuring the geniculate ganglion and the petrosal nerve a very remote one. The possibility of the occurrence of such an injury during the Hartley-Krause method of operating has been suggested by those favoring the N. intermedius (Wrisburg) path of taste conduction in their attempt to explain the loss of taste after ganglion extirpation.

movement of a cotton swab over the surface of the tongue, will give a peculiar tactile sensation which is localizable, anæsthesia to pain, temperature and to touch by the hair æthesiometer meanwhile remaining complete.

It seems not impossible that the chorda, representing as it may the sensory portion of the N. facialis, may contain afferent fibres transmitting qualities other than those of special sense. Köster (loc cit., 1900, p. 571) as a result of his experimental work was led to this same conclusion and in his second paper (loc cit., 1902, p. 519) reports cases of facial paralysis in which a hemilingual hypæsthesia has accompanied the loss of taste on the anterior area of the tongue.

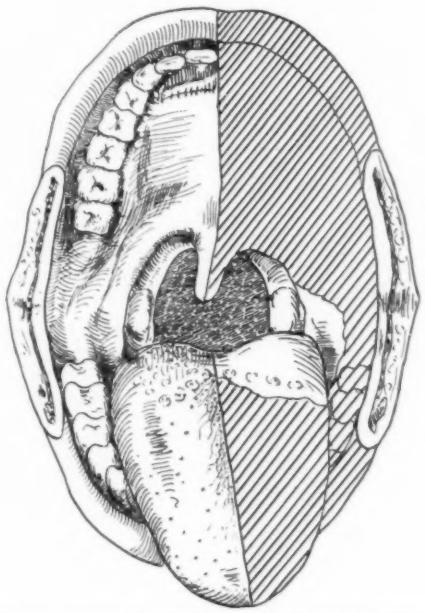

FIG. 2.—Sketch showing the postural deformity with open mouth and during phonation after extirpation of the G. semilunare on the left side. The areas of complete anæsthesia to common forms of sensation indicated by shaded lines.

In making the tests the following precautions have been observed: After thorough rinsing of the mouth with warm water the tongue is protruded and its surface gently dried with a towel. The following system of prearranged signals enables the patient without withdrawing the tongue to indicate, first by a slight nod of the head when he recognizes the presence of anything upon the anæsthetic portion of the tongue, second by raising the hand when the quality of the substance is recognized, and third by pointing to one side or the other to indicate the localization of the taste on the right or left side of the tongue. The substances used have always been in a more or less concentrated solution and most of the tests have been made with the following: simple syrup, quinine or strychnine solutions, acidum hydrochloricum dil. or lemon, a solution of common salt and one pole or the other of a weak faradic or galvanic current. The solutions have been used at the room temperature and have been applied usually with a small cotton swab. The delineation of the moistened area can be observed accurately in case the surface has been previously dried. In some cases the precaution has been taken of staining the fluid with methylene blue as Kiesow[26] has done in his observations.

After each trial the mouth has been cleaned and a sufficient length of time allowed to elapse before making a second test and on any evidence of uncertainty in the interpretation further observations have for the time being been postponed. Examination of the soft palate is comparatively easy, especially upon the operated side, inasmuch as the gagging reflex is abolished by the operation.

It is unnecessary to give the notes of all these cases in full, as there has been such conformity in the findings that a few illustrations will suffice.

CASE I.—The patient, an intelligent German, afflicted for years with the most severe type of right sided trifacial neuralgia, which had recurred promptly after several peripheral operations, entered the hospital suffering too acutely to allow of any preliminary examination of taste sensation. The ganglion (Rt.) was removed with sensory root and three branches in toto, February 15, 1901, the day after admission.

February 26 (11 days).—First observation on taste. Anterior two-thirds of tongue, soft palate, anterior pillar of fauces, completely anæsthetic to common forms of sensibility.

Anterior two-thirds of tongue,—

	Right.	*Left.*
Syrup.	Not recognized in 60 sec.	Recognized immediately.
Salt.	Not recognized in 60 sec.	Recog. immediately.
Quinine.	Not recognized in 60 sec.	Recog. immediately.
HCl. dil.	Not recognized in 60 sec.	Recog. immediately.

The last substance although not recognized on the right gave a sensation of puckering described as "Zusammenziehung." All of these substances were recognized immediately on the posterior part of the tongue.

March 4 (17 days).—Anterior two-thirds of tongue.

	Right.	*Left.*
Syrup.	Recognized in 30 sec.	Recog. immediately.
Salt.	Unrecognized but gave sensation of "Gänzehaut" in 30 seconds.	Recog. immediately.
Quinine.	Questionable.	Recog. immediately.
HCl. dil.	Recog. in 20 seconds.	Recog. immediately.
Elec. taste.	Coppery taste recog. immediately and localized but no "sting". Palate ditto.	Coppery taste recognized immediately and accomp. by elec. "sting". Palate ditto.

March 18 (31 days).—Anterior two-thirds of tongue.

	Right.	*Left.*
Syrup.	Recog. in 15 seconds.	Recog. immediately.
Salt.	Recog. slowly.	Recog. immediately.

Palate.

Syrup recog. immediately on both sides. Anæsthesia remains complete on right.

[26] Kiesow, Zeitschrift für Psychologie und Physiologie der Sinnesorgane, 1902, vol. xxv, p. 415.

March 25 (37 days).—No appreciable difference in reaction time on two sides to sugar, salt, quinine and lemon solutions.

December 11 (10 months).—Areas of post-operative anæsthesia remain practically unchanged. No appreciable overlapping in median line either of face, palate or tongue. No shrinkage of intrabuccal area detected. Slight shrinkage (1-2 cm.) of posterior edge of facial cutaneous area which is anæsthetic to common sensibility.

Taste. Anterior two-thirds of tongue.

	Right.	*Left.*
Syrup. Obs. I.	Recog. in 30 sec.	Recog. in 20 sec.
Obs. II.	Recog. in 30 sec.	Recog. in 20 sec.
Obs. III.	Recog. in 15 sec.	Recog. in 15 sec.
	(About 30 min. interval between observations.)	
Salt.	Recog. immediately.	Recog. immediately.
Lemon.	Recog. in 5 sec.	Recog. in few sec.
HCl. dil.	Recog. "sour" immediately.	Recog. sour plus "sharp" sensation immediately.
Quinine.	Recog. 20 sec.	Recog. 20 sec.
Electric.	"Metallic" taste immediately.	Ditto plus electric "prickle".

Palate.

	Right.	*Left.*
Lemon.	Recognized in five seconds on both sides.	
Quinine.	Recog. immediately, "plainer than on tongue" both sides.	
Salt and Sugar Solutions.	Uncertain on both sides. Tasted but referred to base of tongue.	
Electric taste.	Recog. immediately and metallic taste said to be "plainer than on tongue". No "prickle" felt on right side of palate.	

It is to be noted that taste localization remains perfect over the anæsthetic areas. The solutions were usually applied on the outer edge of the protruded tongue. All substances were recognized immediately over the base of the tongue and a slight touch of the swab holding the quinine solution could be localized on the epiglottis. It is noteworthy that sweet substances on the anæsthetic side of the tongue seemed to call forth reflexly a much more abundant flow of saliva than when placed on the normal side. The patient was confident that the subjective acuteness of taste was equal on the two sides.

The case demonstrates clearly that there was a post-operative transient period of abolition of taste perception with a gradual return to the normal or practically normal state. More delicate tests with solutions of less concentration possibly would be required to assure the absoluteness of the restoration.

The following case shows that this temporary loss may not be complete but merely a lessening of acuity, shown by a prolongation of the reaction time of perception, and furthermore that it is not an immediate consequence of the extirpation.

Case II.—The patient entered the hospital July 8, 1902, during an interval of comparative freedom from pain so that it was possible to make some preliminary observations on taste. These demonstrated that the recognition to all four primary forms of taste was fairly prompt and apparently equal on the anterior and posterior parts of the tongue. The reaction time to bitter substances was somewhat slow anteriorly.

July 12, 1902.—Extirpation of the ganglion (left side).

July 15 (3 days).—Anterior portion of tongue: immediate recognition of sweet and saline substances on anæsthetic as well as normal side of tongue.

July 22 (10 days).—Anterior two-thirds of tongue:

	Left.	*Right.*
Salt.	"Tasted" after 70 sec. and then unrecognized.	Recog. almost immediately.
Syrup.	Tasted after 20 sec.	Recog. immediately.
Quinine.	Not recog.	Recog. in 20 seconds.
HCl. dil.	Recog. in 20 seconds.	Recog. immediately.

July 28 (16 days).—

	Left.	*Right.*
Salt.	Recog. in 3 seconds.	Recog. immediately.
Syrup.	Recog. in 10 seconds.	Recog. immediately.
Quinine.	Recog. in 60 seconds.	Recog. in 20 seconds.

July 31 (19 days).—

Syrup.—"Tasted" almost immediately on left side and localized, but difficulty experienced in recognizing substance for some seconds. A drop of lemon juice recognized immediately on both sides.

August 3 (22 days).—

	Left.	*Right.*
Salt.	Recog. immediately.	Recog. immediately.
Sugar.	Recog. immediately.	Recog. immediately.
Quinine.	Recog. in 30 sec.	Recog. in 30 sec.
HCl. dil.	Recog. immediately.	Recog. immediately.

On the anæsthetic side of the palate very much the same occurrence was appreciable for the two substances normally recognizable there, namely the saline and bitter solutions. On the tenth day salt and quinine were only recognized on the sound side. On the 16th day the bitter solution was immediately recognized on both sides and the saline was localized and identified on the anæsthetic area although less perfectly than on the normal side.

December 10 (5 months).—The facial and intrabuccal areas of post-operative anæsthesia remain practically unchanged except for a slight shrinkage of the posterior border of the former. The left half of the tongue anteriorly is anæsthetic exactly to the mid-line to tactile (hair æsthesiometer) pain (needle) and thermic stimuli. Rubbing with a cotton swab, however, gives the peculiar tactile sensation often noticed in these cases. It is perfectly localizable.

Taste. Anterior two-thirds of tongue.

	Left.	*Right.*
Salt.	Recognized in 15 secs.	Recog. in 10 secs.
Syrup.	Recog. ("sweet") in 15 sec.	Recog. in 20 sec.
HCl. (dil).	Recog, "sour" in 10 sec.	Recog. in 5 sec. "Sour and burned."

Quinine—Recog. alike on both sides of tongue, first as "sweet", and not as "bitter" until after 30 seconds.

Electrical taste—Recog. immediately on both sides but with no "sting" on the left.

It is to be noted that the effort was made in all of these examinations to delude the patient as to the substance chosen for the test and the last (December) observation on this patient shows in how much the element of practice is helpful in reducing the reaction time in recognizing the four or five simple substances employed. In a later examination on this same date most of the substances were recognized, as at the time of the August examination, immediately.

Other illustrations need hardly be given. The element of training must, of course, be taken into consideration and I find that almost invariably patients succeed in identifying taste qualities with much greater promptitude after the experience of a few trials. On the first observation before the operation, the reaction time of recognition for most substances put on the protruded tongue is much longer than on subsequent observations. Considerable variations in facility of recognizing substances are often appreciable on different occasions from fatigue or abstraction even under normal conditions.[27] There are certain things worthy of special attention. In several of the cases there has been no perceptible loss of taste qualities, in so far as our rough methods could detect them at any time, on tongue or palate after operation. It is important also to note that irritating stimuli like the dilute hydrochloric acid and faradic current may still be tasted, localized and recognized as acid or "coppery," but the unpleasant sensation or "sting," owing to the abolition of common sensibility, is no longer perceived. An analogous effect of the operation is to be observed in the case of smell since irritant fumes like those of ammonia can be recognized but no longer irritate the Schneiderian membrane when inhaled on the operated side. The fact also that taste qualities are localizable, in spite of existing anæsthesia to common forms of sensibility, is interesting from a psychological point of view and may be taken as an evidence that the sensory transmission does not occur by a possible commissural path of anastomatic fibres across the median line.

I find it difficult to reconcile my fairly uniform results, that is, uniform in so far as the ultimate preservation of taste is concerned, with the contradictory observations which have been made by so many others. The only explanation which I can offer is that there may be in a considerable percentage of the cases a temporary diminution in its acuity or a complete abolition of taste as has been indicated above, and that this may have been interpreted under certain circumstances as an evidence of permanent loss of this sense. Inasmuch as the temporary period of loss occurs during the first two or three weeks after the neurectomy, a period which roughly may correspond with the average residence of the patient in the hospital and under immediate observation, the return of taste may in some instances have been overlooked.

It seems possible that this early and transient disappearance of taste which several of my cases have shown may be attributable in one way or another to the post-operative degeneration and swelling, which owing to the removal of the ganglion must affect the fibres of the N. lingualis. In this way the neurectomy may indirectly affect the transmission of gustatory impulses from the anterior portion of the tongue without the necessary inference that the chorda fibres actually pass by the trigeminal route to the brain. Thus the mere mechanical pressure of the swollen lingual fibres might accomplish this or else, as Dr. Rusk has suggested to me, there may be a certain toxic effect of the products of degeneration of lingual fibres which temporarily may give a physiological "block" to chorda activities. Intimately intermingled as the fibres of the two nerves are for a part of their course, this might readily take place, and that the chorda fibres remain intact is shown by the early return of taste perception. The time of active degeneration corresponds fairly well with the period of diminution or loss of taste and it has been noticed in a few instances for a day or two after the operation, as in Case I cited above, and before such degeneration may have become complete, that taste was preserved although it subsequently disappeared for a time.

Such a mechanical interference with the normal transmission of impulses may very well explain the extraordinary observations made by Schiff[28] and by Ferrier which were interpreted as an evidence that some taste fibres passed directly along the lingual. They found that section of this nerve above its union with the chorda tympani produced in some cases a partial loss of taste. It is conceivable also that the late fibrous change in the elements of the lingual nerve following upon its atrophy and destruction may in certain cases ultimately interfere with the function of the intermingled fibres destined to form the chorda tympani. This, however, is only a conjecture.

The object of this communication is to negate the possibility of taste transmission by way of the N. trigeminus rather than to advocate any other course for these fibres. It may be said, nevertheless, in passing, that the generally accepted statement to the effect that an intracranial lesion of the N. facialis is unaccompanied by loss of taste, seems to be made on rather slight evidence and should be given the further confirmation, if possible, of experimental observations. The portio intermedia is of considerable size and sufficiently distinct from the portio mollis to escape injury, even though an intracranial lesion may clinically have produced complete facial paralysis. Embryological studies furthermore have

[27] There seems to be little doubt that, as v. Vintschgau originally emphasized, there are special neurones subserving the function of carrying the separate taste qualities just as v. Frey has shown to be the case with the various forms of common sensibility. This has been apparent in many of our observations from the return of certain forms of taste sensation before others after the complete temporary abolition of all of them. Köster in his second paper has called attention to the physiological fact of variable resistance which these different sets of fibres possess, believing for instance that the fibres conveying sensations of "sweet" are more sensitive to injury than those of "sour."

[28] Schiff, Les nerfs gustatifs. Rev. Méd. de la Suisse romande Genève, 1887, t. vii, p. 54. Schiff believed that these fibres passed along the lingual and left it by a small [anatomically inconstant, (Hyrtl.)] branch to the otic ganglion.

established beyond question that the facial nerve is a mixed nerve, whose afferent sensory portion is represented by the N. intermedius and His has shown that the Chorda tympani and the great superficial petrosal in the lower vertebrates, as well as in man, are portions of the VIIth nerve. If, therefore, they are developmentally outgrowths of the geniculate ganglion, on the principles established by His concerning the development of nerves, they must be afferent nerves and would not transmit impulses in a direction toward the Gasserian ganglion, as those believing in the Vth route theory claim that they do.

Judging from the uniform results of observations on this series of cases it may be said in conclusion.

1. That the perception of taste is unaffected on the posterior portion of the tongue and never permanently or completely lost on its anterior two-thirds after removal of the Gasserian ganglion.

2. That a temporary abolition or lessening of the acuity of taste may be found to exist over the anterior and anæsthetic portion of the tongue for some days after the operation.

3. That this temporary loss of function may possibly be occasioned by some interference with chorda transmission brought about by a mechanical or toxic disturbance due to degeneration of the N. lingualis.

4. That a lesion of the trigeminal nerve may be associated with disturbance of taste over the chorda territory without the necessary inference that the nerve is a path for gustatory impulses.

5. That the N. trigeminus in all probability does not convey taste fibres to the brain either from the anterior or posterior portion of the tongue.

ON THE USE OF CLAY MODELING IN THE STUDY OF OSTEOLOGY.

By Robert Orton Moody, M. D.,

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(From the Hearst Anatomical Laboratory of the University of California.)

Before the introduction of the laboratory idea into medicine, osteology was studied either by means of books or by the use of books and bones. In many places it has been and still is difficult to get skeletons, leaving medical schools to find recourse to the use of stock collections, which are loaned to students on the principle of the circulating library. With the reform that came in teaching methods, the chief modification in the system has been in the redistribution of the student's time, the greater portion of which is now spent in direct study of the skeleton. In fact, this follows a marked tendency noted in many branches to adopt more and more, simple objective methods and to depend less and less on descriptive work. This principle, which may be stated as the exchange of visual for verbal images, is now suggestively emphasized by the growing demand for good anatomical atlases. Word descriptions alone no longer suffice as a vehicle for ideas of form or relations of structures that occupy three dimensions of space. Of all the improved methods in the study of osteology, the introduction of drawing gave us the easiest device by which we could be assured that the student spent a certain amount of time with the specimen. To this method the use of clay modeling has recently been added in the routine work of classes in osteology. In one way or another, however, the use of models, in anatomy, is quite old, and it is only necessary to refer to the beautiful series of Steger and Ziegler to show the great advances that have been made along this line. Dr. Clarence Webster of Chicago has for some time employed clay models as a method of recording operative procedures in gynecology. In the anatomical laboratory of the Johns Hopkins University it was first used in routine courses in osteology. Later the method was adopted and expanded in the University of Chicago. A short account of the method as it is employed in the anatomical laboratory at Chicago, together with its results, has been recently published.[1]

In the course in osteology in this University, the method has been extensively tested. Here, students are required in the laboratory work to model as well as draw all the bones of the body. No attempt is made to have the student memorize muscle attachments or learn relations of the ligaments. They are taken up later during the period of dissection, when these structures are directly before the student. The course is entirely objective and nothing concerning the bones is learned that cannot be seen. A few general lectures are given to outline the development of the skeleton and to discuss certain facts of comparative osteology. Occasional recitations are held to control chiefly the student's reading and to develop a power of systematic, objective description distinct from that obtained in the general text-books.

[1] It is interesting to note also that Cone (Bulletin of the Johns Hopkins Hospital, Vol. XIII, June, 1902) demonstrated before the Medical Society of the Johns Hopkins Hospital a method of clay modeling in the study of osteology.

University Record. Vol. 7, No. 3, 1902.

The outfit of the student consists of a paraffined board and two modeling tools, Boxwood 64 and E. & B. No. 3. The first of the instruments may be easily made by any one who can use a jack-knife, and the second by any one who has in addition a little manual dexterity. The board should be a piece of kiln-dried finished wood about 60 centimeters long, 50 centimeters wide, and 2 centimeters thick. It is well to have it coated with boiling paraffin to prevent the clay from sticking or the board from warping. We have found it desirable to use the best potter's clay that can be obtained. This should be free from stains and foreign bodies. It is prepared by grinding it to a fine powder and, after passing it through a sieve, adding a sufficient quantity of water. This mode of preparation not only removes foreign bodies but permits the water to act evenly on the clay. It is important to have the two homogeneously mixed. Clay that is more moist in some parts than others is difficult to mold and liable to crack when dry, thus destroying the model. It is ready for use when it contains enough water to mold easily but not sufficient to make it sticky. When there is a little too much moisture, kneading will often bring it to a proper consistency, but if it is very wet and sticky some powdered clay may be added to take up the excess. In this case, however, the kneading should be thorough in order that the clay shall have throughout a uniform moisture. When given to the students, the clay should be in the proper state of plasticity for immediate use, but it is well, however, to have the student thoroughly work it over with his hands, for the better the clay is worked, the more readily it can be molded. The bones should be completed while the clay is still in a plastic condition. This state can be maintained indefinitely by covering the model with wet cloths during the various stages of its preparation. There is a notable tendency among the students, especially before they have learned how to handle soft clay, to outline the bone roughly, let the clay harden, and then carve and finish the model. This, however, is unsatisfactory, as the student who carves loses the training of the tactile sense and often cannot make the necessary changes which the instructor suggests to improve the model or make it conform more closely to the original specimen. In fact, the less modeling the student does with his tools and the more he does with his fingers, the greater will be the benefit of the work to him. The use of the fingers, perhaps, develops to a slight degree the muscle sense, but through the sense of touch one gets a conception of the form and relations of the bone that can be obtained in no other way. Most of the bones are modeled as isolated objects, but some of them, preferably the more fragile ones, like the fibula, may be modeled on a base. The skull, the wrist and hand, and the ankle and foot are usually modeled on a base. To model some of the long bones which have naturally only one or two points of contact with the underlying board it is often necessary to support the shaft at short intervals by clay pillars which remain under it until the model is dry. When the student has completed a specimen the original bone as well as the model is submitted to an instructor. This, too, should be done while the model is still in a plastic state, for a careful comparison of the model with the bone usually reveals the necessity of changes, sometimes quite fundamental. Not infrequently the student carries the modeling of one or two dimensions nearly to completion without due regard to the others. In order to produce good results it is naturally necessary to bear in mind constantly the relations of one to the other two dimensions. When the bone is finished and accepted by an instructor it is marked with the name or initials of the maker and placed with the remainder of his specimens. The general form and appearance of a model made on a base may often be brought into sharp relief by coating the base with shellac and then with enamel paint or by coating both base and model with shellac and paint of different colors for a contrast. If it desired to make the models permanent they may be burned like pottery. At the end of the time scheduled for osteology a practical examination is given in which each student is required to model one bone and draw several others entirely from memory.

The value of the method is obvious, for in drawing the student is forced to depend on the more or less arbitrary laws of perspective, while in modeling he is not only enabled to represent the object in three dimensions just as it exists in nature, but registers repeated visual impressions and probably uses his muscle sense as well as the sense of touch. Owing to the importance of a certain knowledge of drawing to the student of medicine, he is required as a matter of routine to draw the bones of the body, chiefly as a general training. The value of drawing, however, is not to be underestimated as an aid to modeling in the study of osteology. During his course the student should be required to use text-books and read the descriptions of the bones as he models. The tendency in general is for a dissociation of these two important portions of the work, as the average student prefers to make his model and subsequently read and identify its parts. He should associate the names of objects with their images and the only way that this can be enforced is to insist on laboratory reading.

It requires, in time, about six half days a week for seven weeks. The average and poorer students may require some extra time outside of the laboratory periods. Two afternoons a week for three weeks are devoted to drawing in order to criticize the student's technique. The remainder of the drawing, however, is done outside of the regular class hours. Following is a schedule which, in our experience, has been best adapted to work of this nature:

OUTLINE.

24 hours per week.

1st week:
Clavicle.
Scapula.
Sternum.

2d week:
Humerus.
Radius.
Ulna.
Ribs—1 typical and 1 of each atypical.

3d week:
Wrist and hand.
Vertebræ—1 typical of each region and 1 of each atypical and sacrum.

4th week:
Os innominatum.
Femur.
Tibia.

5th week:
Ankle and foot.
Fibula.

6th and 7th weeks:
Skull.

It has seemed wise, in view of the various pedagogical changes which have been recently introduced in anatomy, to have some definite experimental evidence of the value of the method, to test, if possible, the relative worth of visual and verbal images in conveying ideas of form. Accordingly after the regular work of the class was finished an unknown bone was accurately described and photographed. The class was divided into three groups; the first received the photographs alone, the second the photographs and description, while the third was simply given the verbal picture. With these aids the students were required to model the bone in clay. The specimen is represented in Figures 4a, 4b, while following is the detailed description of the bone from which they worked.

This left scapula is a thin, flat bone, approximating in shape a paddle or an isosceles triangle with curved outlines having the medial border for its base and the glenoid cavity for its apex. It has two surfaces, dorsal and ventral, three borders, medial, cephalic, and caudal, and three angles, lateral, meso-caudal, and meso-cephalic.

If the bone rests on its curved caudal border the straight base line of that border, extending from the meso-caudal angle to the caudal border of the glenoid cavity, is 5½ inches long. The caudo-cephalic diameter of the bone at the lateral extremity of the base line is 1½ inches, at its medial extremity 3¼ inches. The caudal border is a little more than ⅜ of an inch thick throughout its entire length. From the edge of the glenoid cavity which forms most of the lateral angle this border slopes sharply cephalad so that ¾ of an inch from the edge it has sloped ½ an inch. From this point for 2¾ inches it is straight and then slopes gradually to the meso-caudal angle.

For a distance of 1⅜ inches from the meso-caudal angle the caudal border presents two surfaces, one approximately triangular placed ventrally, looking caudad is ⅜ of an inch wide at the medial border and ⅛ of an inch wide at its apex. The other surface ¼ of an inch wide looks dorsad: ⅜ of an inch from the medial border it begins to slope ventro-caudad and winding around the apex of the triangular surface merges with the adjacent rounded part of the border. The rounded part of the border extends laterad 1¼ inches rounding toward a ridge which separates this border from the dorsal surface and also rounding toward and becoming continuous with the ventral surface. Laterad of this round portion the caudal border for 2¼ inches presents two surfaces, one surface begins as a ridge looking dorsad and gradually widens so that it becomes $\frac{3}{16}$ of an inch wide and looks directly caudad. The other surface continuous with the rounded portion of the border is $\frac{5}{16}$ of an inch wide and its medial extremity looks caudad but turns so that its lateral half is on a plane midway between the plane of the caudal surface and the plane of the ventral surface. The lateral ¾ of an inch of this border presents a triangular tuberosity and the convex caudal border of the glenoid cavity. The triangular tuberosity ⅜ of an inch long has its apex directed mesad.

If from a point on the diameter that passes through the meso-caudal angle 2⅜ inches cephalad of the angle a perpendicular be dropped mesad ⅜ of an inch in length, its termination will be at the point of greatest convexity of the medial border. The medial border is convex, ⅛ of an inch thick throughout most of its extent and ¼ of an inch thick at the caudal end.

If at a point on the caudal base line 2⅛ inches laterad from the meso-caudal angle a perpendicular 3⅜ inches long be drawn cephalad its terminal point will be the point of greatest convexity of the cephalic border. A similar perpendicular whose terminal point would be in the cephalic border, erected 2 inches mesad from the latero-caudal angle would be 3 inches long.

At the neck the bone is 1½ inches in diameter. The cephalic border is thin, convex and extends ⅞ of an inch laterad beyond the caudal border. It terminates in the tuberosity which projects beyond the glenoid cavity ½ an inch. This tuberosity has a rounding surface looking in its medial part cephalad, dorsad and mesad, and it its lateral part cephalad, dorsad and laterad. The caudal surface of the part of the tuberosity that projects beyond the glenoid cavity is smooth and continuous with the articular surface of the cavity.

The meso-cephalic angle is thin and rounded, the meso-caudal angle is thick and nearly a right angle, but slightly obtuse.

The dorsal surface is divided by a spine into a supra-spinous fossa and an infra-spinous fossa. The spine runs from the middle border of the glenoid cavity through a

FIG. 1.—A number of average specimens of the work of the class picked haphazard from the entire series.

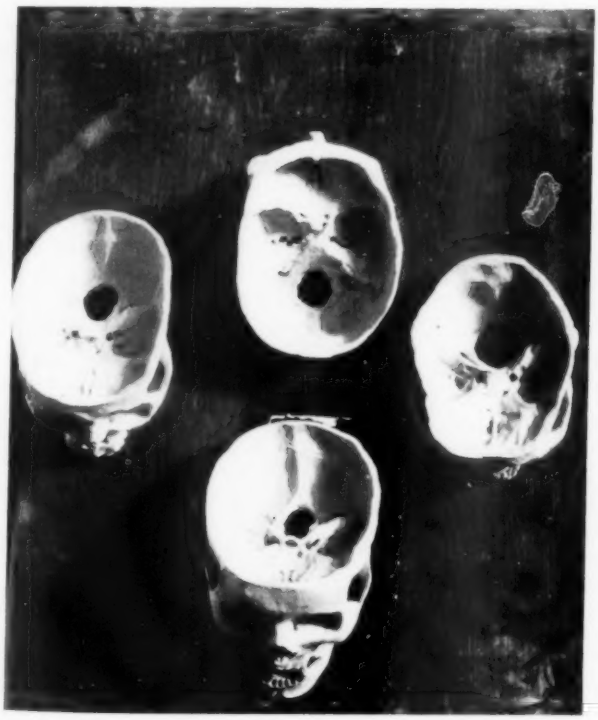

FIG. 2.—Four skulls modeled during the laboratory hours. One shows the method of modeling and coloring the base.

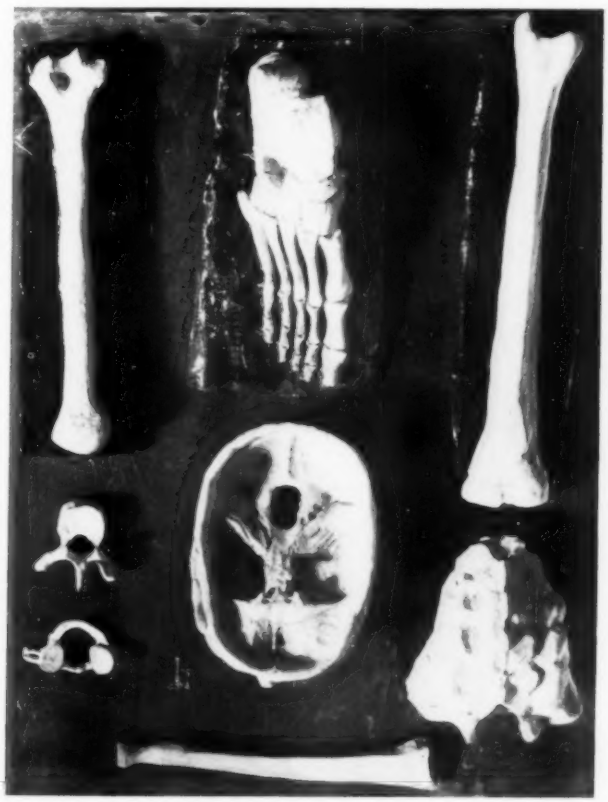

FIG. 3.—Bones modeled from memory during the examination by some of the better students of the class.

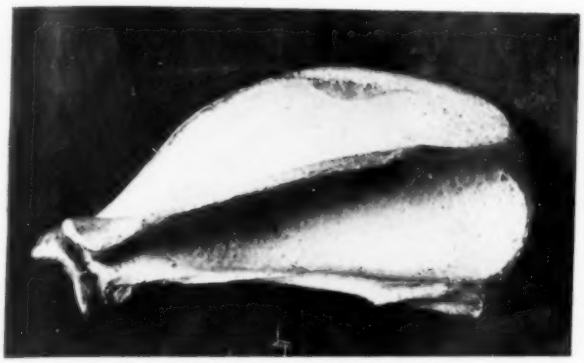

FIG. 4a.—Dorsal view. Scapula which was used in class experiment.

FIG. 4b.—Ventral view. Scapula which was used in class experiment.

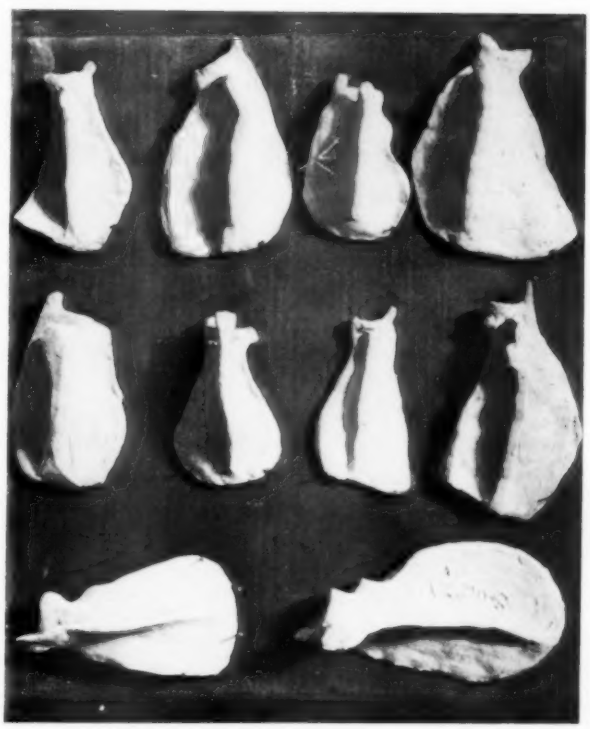

FIG. 5.—Clay models made from a verbal description of the scapula shown in Fig. 4.

point $1\frac{5}{8}$ inches cephalad of the caudal base line, in a perpendicular erected $1\frac{1}{2}$ inches mesad of the lateral extremity of the base line, to the medial border. The infra-spinous fossa for $\frac{1}{2}$ inch at its lateral extremity is flat, for the next inch it slopes mesad, and becomes concave from the spine to the caudal border. Throughout the rest of its length it is flat from the base of the spine nearly to the caudal border, then curves sharply dorsad to that border. Mesad the infra-spinous fossa terminates in a very shallow overhanging lip formed by the medial border. The supra-spinous fossa in its middle $\frac{3}{4}$ is slightly concave from the spine to the cephalic border and flat throughout the rest of its extent rounding toward the cephalic border just before reaching it. The *ventral surface* is slightly concave from the medial to the lateral extremity. It is subdivided by two slight ridges marking the insertion of muscles into three triangular areas. The cephalic line starts at a point $\frac{3}{4}$ of an inch from the cephalic border and $1\frac{1}{4}$ inches from the margin of the glenoid cavity, runs to the meso-cephalic angle. The caudal line starts at a point $\frac{3}{8}$ of an inch from the caudal border and 2 inches from the margin of the glenoid cavity, terminates at a point $1\frac{1}{2}$ inches cephalad of the meso-caudal angle. The middle area between these two ridges is slightly concave. An irregular rough curved ridge runs from the middle of the cephalic border and at right angles to it to the point of intersection with the cephalic line where it turns and runs to a point of intersection with the caudal line $\frac{1}{2}$ inch from the medial border. It then turns sharply and runs to the meso-caudal angle. The *spine* which is $\frac{1}{8}$ of an inch thick and begins as a flattened triangular eminence at the medial border of the dorsal surface slopes dorsally toward the lateral extremity so that it is 1 inch high at the middle of the bone and the same height at its termination $\frac{3}{8}$ of an inch from the margin of the glenoid cavity. It has two surfaces, cephalic and caudal, and two borders, dorsal and lateral. The cephalic surface is flat. The caudal surface is very slightly concave owing to the overhanging dorsal border. The dorsal border is flat and $\frac{3}{16}$ of an inch wide from the apex of the smooth triangular eminence to within 2 inches of its lateral extremity where it changes its direction so as to look dorsad and cephalad. $1\frac{1}{2}$ inches from the lateral extremity it expands caudally to form the acromion process which is $\frac{1}{2}$ an inch wide and looks dorsad and slightly cephalad. The lateral border is $\frac{3}{16}$ of an inch thick and rounded.

The oval glenoid cavity which forms the lateral angle of the bone has a caudo-cephalic diameter of 1 inch and a dorso-ventral diameter of $\frac{5}{8}$ of an inch. It is concave in the direction of both diameters, being more concave in its caudo-cephalic diameter. At its cephalic end it terminates in the smooth triangular surface of the projecting tuberosity of the cephalic border. This surface looks almost caudad but slopes cephalad forming a slightly obtuse angle with the glenoid cavity and is $\frac{1}{2}$ an inch in length from base to apex.

A few of the typical results are shown in Figure 5. Those students who were provided simply with the photograph finished modeling in a little over an hour, those who had both photograph and description took between two and three hours, while those who worked from the description alone occupied from three to four hours in the making of a model. The results, moreover, were not strictly comparable, for the class was divided into groups unequal in size and ability. Group three contained the best students and over two-thirds of the class. The finished models seem when liberally interpreted to emphasize especially the inadequacy of verbal images to represent structures occupying three dimensions of space. Certain students as will be seen from an inspection of the models produced a right, while others modeled a left scapula, although this point was distinctly mentioned. They show, moreover, very different conceptions of size, form and relations, and if the results are compared with Figure 3, which represents bones modeled from memory during the regular examination of the class, it seems as though the visual image is much superior to the verbal as a vehicle of the concept of form. This experiment may have an important bearing on the question of lectures covering structures occupying three dimensions. Unless provided with the object it would be difficult for an average class to follow the intricacies of the description, and the sum total of good accruing from the method would simply be a certain degree of familiarity with the terminology. It is possible that students of gross anatomy might be helped by lectures after they had dissected the body once or twice, although there is some question whether the time could not be more profitably spent in the quest of actual objective information, for, as Jordan says, the only knowledge that is really worth having is knowledge which the student can test for himself.

In conclusion, it is a pleasure to express my thanks to Professor J. M. Flint for his kind assistance in the preparation of this article.

STUDIES IN TYPHOID FEVER.

SERIES I-II-III.

The papers on Typhoid Fever, edited by Professor William Osler, M. D., and printed in Volumes IV, V and VIII of The Johns Hopkins Hospital Reports have been brought together, and bound in cloth.

The volume includes thirty-five papers by Doctors Osler, Thayer, Hewetson, Blumer, Flexner, Reed, Parsons, Finney, Cushing, Lyon, Mitchell, Hamburger, Dobbin, Camac, Gwyn, Emerson and Young. It contains 776 pages, large octavo, with illustrations. It gives an analysis and study of the cases of Typhoid Fever in The Johns Hopkins Hospital for the past ten years.

The price is $5.00 per copy. Only a few copies of the volume are on sale. Those wishing to purchase should address their orders to the JOHNS HOPKINS PRESS, BALTIMORE, MARYLAND.

THE TREATMENT OF AURAL EXOSTOSES.

By H. O. Reik, M. D., *Clinical Assistant in Ophthalmology and Otology.*

My object in speaking of the treatment of aural exostoses is to suggest the revision of a statement common to practically all of the text-books on otology which I believe constitutes, for the present day, a matter of false teaching. Every such book that I have been able to consult for advice on this subject lays down the rule that an exostosis of the external auditory canal is not to be operated upon unless it is so completely blocking the canal that it prevents the exit of pus from a coexisting suppurative otitis media and thus endangers the life of the patient, or, unless because of its size it obstructs the entrance of sound waves and produces a profound deafness in a person who is also deaf on the other side from this or any other cause. I have found but one exception, the American Text-book of Diseases of the Eye, Ear, Nose and Throat, and that book gives conflicting advice in that the the author of the chapter on Diseases of the Auricle recommends the wider application of operative measures, while the author of the chapter upon Operations upon the Ear reiterates the advice referred to above. Since medical treatment looking to the absorption of these bony growths has been of no avail and as they threaten the individual with either loss of hearing or more serious trouble, I have been at some pains searching the literature to discover a reason for this general counsel of non-intervention.

The law probably originated with Toynbee, for the first reference containing it which I have found was published by him in 1849, but, strange to say, the same sentiment has been repeated in every work on otology published since that date in spite of the numerous articles that have meanwhile appeared giving the histories of cases successfully operated upon and notwithstanding the improvement in surgical methods since that period or the oft-repeated pleadings of otologists of standing, especially Fields, Delstanche, Jr., and Benson, for early operations.

One can readily understand why Toynbee, Von Troeltsch and the writers of that day should have taken the position they did against any operative measures. It is to be remembered that anæsthesia was unknown then and antisepsis was undreamed of, so that operations were painful and even the simpler ones were usually followed by suppuration. Furthermore, the progress in the methods of operating in such cases is interesting. The first attempts at removal consisted in an effort to reduce the growth by the application of nitric acid or other escharotics. This was followed by the use of sponge or laminaria tents to dilate the space between the tumor and the canal wall and set up an inflammatory process to cause a breaking down of the growth. Next came an effort to bore through the bone with an iron wire at white heat and, later, the employment of electrolysis. Naturally all of these methods were terribly painful, required frequent sittings and were uncertain in their results. With the general advance of surgery came an improvement in the manner of operating. Anæsthesia disposed of the pain and shortened the time of operation; the introduction of surgical cleanliness made such operations perfectly safe except for the slight danger that accompanies anæsthesia; an American otologist, Dr. Mathewson of Brooklyn, taking up the American dental engine, adapted special drills to it and found a rapid and easy way of removing the bone; and others have more recently by the aid of the mastoid chisel and gouges succeeded perhaps even better.

I expected that a review of the literature would disclose some other reason for the remarkable unanimity with which writers have continued to apply Toynbee's dictum, but if any such reason exists I have failed to find it after a very thorough search. I have examined the records of 139 cases that have been operated upon and in no single instance did any serious complication result from or follow the operation. In a large proportion of these cases a suppurative otitis media existed at the time of operation or had been present before and the operation was done during a period of its quiescence. Every case is reported to have been cured, immediately or ultimately, both as to the removal of the obstruction and the relief of the otorrhœa or the deafness, whichever may have been the cause for intervention. In a very small percentage of cases an infective otitis media was produced by the operation through careless or unavoidable injury to the tympanic membrane. In every case of this kind, however, the discharge was promptly controlled and the membrane soon healed. Occasionally the operation was successfully performed after the pent-up secretions had started an active disturbance in the mastoid. Several similar cases are reported, not operated upon however, in which death resulted from meningitis or mastoiditis followed by general infection, where the mastoid disease was probably correctly traced to the obstructing mass in the canal.

There have been a much larger number of cases operated upon than have been reported, for in some parts of the world, particularly in England, it is a common affection. Undoubtedly, too, there have been a number of failures, descriptions of which have not sought the light of publication, but allowing for these possibilities and giving consideration to the points mentioned above, I think one is justified in taking issue with the text-book statements and in urging, as others have done before, surgical treatment of these growths without waiting for them to become particularly, and perhaps dangerously, troublesome. When done early the operation is much simpler and the operator has much better control of the field than when the canal is completely obstructed by the growth. When otorrhœa exists its treatment is rendered more easy and its cure more

certain and permanent by the prompt removal of the growth even though there be a passage-way still sufficiently large to permit egress of the pus. When there is no history of purulent otitis, either present or past, it is still better to operate early for we thus save the patient, in the words of Benson, "the dreadful misery of growing deaf, with all its isolation and despondency."

Exhibition of Patient.—In this connection I would like to show a case of exostosis occurring in a man 45 years of age, in good health, without any other evidence of osseous hyperplasia. His right ear is perfectly normal. The left external auditory canal is almost completely obstructed by a sessile exostosis springing from the posterior wall about 10 mm. from the tragus; there is only a narrow slit between the growth and the antero-superior wall. There is no history of any previous otorrhœa, but the case corresponds to those described by Mr. Fields who so frequently found these growths occurring in persons addicted to excessive bathing or diving in salt water. This man tells me that since early boyhood he has been fond of swimming whenever the opportunity offered. His bone conduction for tuning forks is perfect but the obstruction to aerial conduction is so great that he can only hear very loudly-spoken words or the watch on close contact. I have advised extirpation of the bony obstruction.

DISCUSSION.

DR. RANDOLPH.—I think it should be remembered, in connection with these exostoses, that they are very slow-growing. We may see one of a certain size and if permitted to examine it again ten years later find that there has been almost no increase in size. Dr. Reik reminded me this evening of a case which I saw at the clinic last year in a patient who could hear fairly well and who was having no trouble. I do not remember that I advised an operation upon him, at least I did not impress upon him that it was important to have it done and he went away with the impression that it ought not to be done. The point I wish to impress is this, that these cases should be seen from time to time before an operation is done. I have seen six cases and have operated upon two, in both of which the canal was occluded by the growth. It is astonishing how well these patients may hear even after the growth has passed across the lumen of the canal.

I think one of the reasons why otologists have generally refused to operate upon these growths is the intense reaction that may follow the operation. I remember a case which came to me a year ago after an operation by an otologist in this city where there was an intense reaction and where not only the whole auricle but also the side of the head was swollen. The operation had been performed with the dental engine. The reactions following operations in the external auditory canal are often very intense no matter how perfect the technique of the operator, for it is a difficult place to secure satisfactory drainage, and this being the case nothing would be more likely than an infection of the middle ear from the canal. I would like to have Doctor Reik give the subsequent history of the boy whom I saw last year, for I believe he said that he had seen him quite recently and that an inflammation of the middle ear had set up. Of course where an obstruction to discharge is present the indications for operation are strong. In such a case I should not hesitate to operate, but I believe if I should see another case of exostosis I would be rather inclined to keep the case under observation for a time and watch its behavior and not operate unless it was to make an exit for a purulent discharge or in case there was profound deafness in the fellow ear.

DR. REIK.—Would you operate upon such a case as is represented by this patient I have just exhibited?

DR. RANDOLPH.—I am unable to say as I have not examined him very carefully.

DR. HURD.—Did you not present a similar case a year or so ago before this society as one not calling for an operation?

DR. RANDOLPH.—Not exactly, as the man whom I exhibited a year ago had an exostosis which did not quite block the canal, and if I remember aright his hearing was good on that side.

I would like to refer again to the operation in these cases and ask Dr. Reik what operation he prefers. I perforated the mass in my cases by the slow action of silver nitrate and while the treatment consumed a good deal of time I was satisfied at getting the canal perfectly clear and that too without any discomfort or risk to the patient. At no time was there reaction of any moment and no closing of the canal by swelling. I am opposed to the use of other cauterizing agents than silver nitrate.

DR. REIK.—The patient Dr. Randolph inquired about, and upon whom I operated recently, serves as an excellent illustration of the point made in my paper, that it is important to remove these exostoses before they cause any pronounced trouble. At the time Dr. Randolph saw him he was troubled only by partial deafness and operation was not advised. A year later the patient came to me with a foul smelling otorrhœa and other symptoms pointing to inflammation of the middle ear with commencing mastoid involvement. It was necessary to remove the obstruction at once to secure proper drainage of the tympanum, and this being done the otitis media was soon cured.

Of course, one can operate upon such a case even after serious complications have arisen but although he may be successful in removing the growth and in checking or curing the inflammation he can never thoroughly repair the damage done to the drum membrane and ossicles.

In regard to the method of operating, my own preference is for the chisel and mallet wherever possible; the dental drill may be serviceable in some cases. If the growth is large or situated deep in the osseous portion of the canal the operation is rendered much easier by following Dr. Knapp's suggestion of detaching the auricle and drawing it forward, as in the mastoid operation, so as to expose the tumor at a much shorter distance from the operator. Having completed the removal of the exostosis the auricle is stitched

back in place, an antiseptic dressing applied, the canal plugged with iodoform gauze and the patient kept quiet for a few days. This plan was followed in my case, the dressings in the canal being changed frequently on account of the otorrhœa, and the patient sent home well at the end of a week.

I can see no good reason for deferring operation upon the patient before you. The auditory canal is almost completely blocked and his hearing reduced to a small fraction of the normal. It is true that his other ear is perfectly good but inasmuch as an operation under such circumstances is a simple and safe procedure why not try to restore his hearing on this side?

DR. HURD.—I fancy the general surgeons would operate without question in all these cases.

PROCEEDINGS OF SOCIETIES.

THE JOHNS HOPKINS HOSPITAL MEDICAL SOCIETY.

Monday, October 6, 1902.

The meeting was called to order by Dr. Hurd and the election of officers postponed for a later meeting.

The Treatment of Aural Exostoses. DR. REIK.

See this BULLETIN, page 82.

The Importance of a More Radical Operation for Carcinoma Cervicis Uteri as Suggested by Pathological Findings in the Parametrium. DR. SAMPSON.

See BULLETIN for December, 1902, page 299.

DISCUSSION.

DR. HURD.—I understand that Dr. Tausig of St. Louis, a former pupil of Wertheim, is here. I would ask him to speak on this subject if he is willing to do so.

DR. TAUSIG.—I think there can be no doubt but that Dr. Sampson has developed a very interesting and new form of operation. Of course the point is mainly that he has made it even more radical than Wertheim's which up to this time has been the most radical one proposed. He wants not only to remove the glands but the tissue between the glands and the cervix, and I think the point he has brought out about the mortality will, of course, be the deciding feature.

We have to consider every case that is lost during operation as counting against that operation, just as much as where the disease returns it is counted against the less radical treatment. In our attempts to make the operation more radical we must be very careful not to reduce the sum total of cures.

Professor Wertheim has, of course, developed the technique of his operation so that while his mortality at first was something like 33 per cent, in his last 30 cases it was only 10 per cent. He had a large number of fistulæ develop and I know of one case where the kidney condition afterwards was responsible for the death of the patient, so now, in the last few cases, where the ureter was surrounded by cancerous tissue, he has resected it and he does not hesitate to resect the bladder and rectum where it appears necessary.

October 20, 1902.

The meeting was called to order by the president, Dr. William Osler.

Aneurism of the Aorta. DR. MCCRAE.

One of the cases shown at the last meeting reminds me to bring this case to-night, which shows features of change in the signs of an aneurism of the aorta. The patient is a colored man, 49 years of age, first admitted in December of 1901, complaining of cold and shortness of breath. He had rheumatism at eight years of age, had been a light user of alcohol and was much exposed to the weather by his work. There is no history of lues. His trouble began with a cold and cough, but he continued at work in spite of these and pain in the left thorax. On examination there was a definite heave of the manubrium but no visible pulsation seen in the back and there was nothing definite felt on palpation. The radial pulses were equal and the lung examination was negative. The only symptoms then were pain and cough. The only sign was the heaving pulsation. He was discharged after ten days' stay in the hospital perfectly comfortable and apparently well.

In July of 1902 he again caught cold, as he said, and had a husky voice with attacks of dyspnœa. He came in again on the 15th of October complaining as at the last visit, but on examination we found a marked change. He had considerable dyspnœa, quite marked stridor, husky voice and a peculiar brassy cough. On the right side of the sternum there was a very prominent visible pulsation that could be seen ten or twelve feet from the patient. There was an area of definite local pulsation in the third right interspace with a diastolic shock on palpation. On percussion there was dulness, but nothing unusual was noticed on auscultation. The sounds over the lungs were exceedingly interesting. Over the upper right front there was marked tympany, while over the left the note was normal. Next day the prominence was still visible, but there was dulness over the upper left front and the expansion was diminished to the left. Between Saturday and Sunday there was a marked alteration of these signs. The prominence visible to the right had disappeared completely and a slighter prominence become visible to the left. The dulness to the right disappeared and the diastolic

shock with it. He now shows dulness on percussion and well marked diastolic shock on palpation.

The heart condition was also changed. On admission there was no point of maximum impulse to be made out, but there is now an impulse outside the nipple line, which one can see several feet away.

Probably the most interesting change is in the lung sounds. On admission we interpreted those as follows: The area of tympany on the right was probably due to pressure. On the left, where there was diminished expansion, we thought the bronchus was pressed upon and the air space reduced. In the last twenty-four hours the right lung has improved a great deal, but the left lung dulness has increased until there is flatness from apex to base throughout the back. There is nothing definitely felt in the episternal notch and no tracheal tug. Within the last two hours a systolic murmur has appeared which is heard throughout the right side of the chest and the left radial pulse shows a lower pressure than the right.

The points of special interest are the change in what might be the aneurism itself. The man showed a marked pulsation on the right, associated with diastolic shock, which we thought was due to an aneurism. Three days later there was disappearance of the shock, dulness and pulsation, with later a transference of these to the opposite side of the chest.

DISCUSSION.

DR. OSLER.—We have had one or two instances of the disappearance of pulsating tumors. Some of you may remember the old Swede upon whom Dr. Finney operated two years ago. After wiring of the sac the tumor disappeared and the prominence almost completely left before he went out of the hospital. What is known as dynamic pulsation, seen most often to the right of the sternum in aortic insufficiency, may disappear. In cases of ulcerative endocarditis with marked anæmia there may be a pulsation most suggestive of aneurism, but which, as in a case in Ward E some years ago, may disappear.

Aneurism of Upper Part of Thoracic Aorta. DR. OSLER.

An exceedingly interesting aneurism came to section today, which illustrates the obscurity of some cases of thoracic aneurism. A man, 45 years old, was admitted first in February of last year with pain in the back and side and shortness of breath, which had lasted since the summer of 1900. In November of that year and throughout the winter he had dyspnœa and had to sleep in a sitting posture. There was no cough and no dysphagia. There was a diffuse shock, or impulse, best felt to the left side of the sternum, but no localized pulsation, no diastolic shock and the second sound was not accentuated. He left the hospital somewhat improved, but was admitted a second time in August, 1901, with the same symptoms, but with some dulness to the left of the manubrium. There were also much pain and tenderness in the abdomen at that time. His third admission was on August 20 of this year, after he had had several fainting spells and had become profoundly anæmic. He had a diffuse impulse in the chest, but no localized shock and the diagnosis of aneurism was made more from the shortness of breath, the dyspnœa, the pain in the chest and the diffuse impulse. On the 14th of October he vomited blood and this was repeated on the 15th and 19th, when he also passed a large quantity of blood from the rectum. He became very anæmic from the loss of blood and died on the 19th.

The aneurism is an interesting one and illustrates the differences between the aneurism which causes only symptoms and the aneurism which causes only physical signs. An aneurism in the ascending part of the arch may cause neither physical signs nor symptoms; before the patient has any symptoms, or the aneurism is large enough to produce physical signs there may be rupture.

Aneurism of the transverse portion of the arch as a rule produces both symptoms and physical signs. It presses upon the nerves, upon the windpipe and the gullet, producing pain and other symptoms. It comes forward and erodes the ribs or sternum and presents a prominent tumor.

Aneurism of the terminal portion and of the thoracic aorta produces symptoms but often no physical signs. This man had such a condition. The specimen shows a moderate dilatation of the arch and at the terminal portion, or the beginning of the thoracic aorta there is a sac the size of a small orange which projects backwards and is closely adherent to the spine, which is slightly eroded. We were very much puzzled to account for the bleeding. There was no dysphagia and we did not think it could press on the gullet. The autopsy showed an ulcer of the stomach with an eroded artery.

Exhibition of Cases showing the Effect of X-ray Treatment of Skin Cancer. DR. GILCHRIST.

Dr. Gilchrist exhibited patients and lantern slides to show the improvement which had resulted in three cases of skin cancer after the use of the X-ray.

Cryoscopic Test of Urine. DR. TINKER.

To appear later.

November 3, 1902.

The meeting was called to order by Dr. Hurd.

The following officers were unanimously elected for the ensuing year:

President, Dr. J. Whitridge Williams.

Secretary, Dr. M. B. Tinker.

Typhoid Spine. DR. MCCRAE.

The first case to be shown to-night is one that presents two rather interesting features, one of which is rare (it being only the seventh instance we have had in the hospital), and the other one which has occurred but once in our hospital records. The patient has suffered a long continued attack of typhoid fever without special features, except abdominal

pain with hiccoughing and vomiting. His convalescence was very slow and he objected to being discharged from the hospital although he had been kept in for a long time. He is readmitted with the history that he had been at work for a week, when, on October 25, he complained of severe pain in the back, associated with the ordinary features of what we term typhoid spine. There is little question that the man is an example of the condition described under that term.

The second feature is a rhythmical contraction of the abdominal muscles which you can readily see. We found on examination that the abdominal muscles were contracting at the rate of about seventy-five to the minute, and, at first, the condition suggested a transmitted pulsation from the aorta, but it was found to be faster and not synchronous with the pulse. It was so marked to-day that on putting the two hands in the flanks they were appreciably moved in and out by the contractions of the recti muscles. There can be no question I think that the condition is a neurotic one, a hysterical contraction of the muscles. When he sleeps the contractions stop. To-night I went into the ward and found him asleep and after he awoke it was fully five minutes before the contractions appeared again. We tried administering a few whiffs of chloroform to see if that stopped them, but it seemed instead to aggravate them.

Aneurism of Abdominal Aorta or Coeliac Axis. DR. CLARKE.

Dr. McCrae asked me to show this case, which presents some interesting physical signs and a mistake in diagnosis which was made sometime ago. The patient is a German, 43 years of age, who for the past fifteen or twenty years has been a pilot; has had no specific disease, but has been a heavy, though irregular, drinker. He was well until five years ago, when he first noticed a severe pain across the lower part of the abdomen. This was paroxysmal and lasted about five weeks. He was treated by a doctor, who called it either neuralgia or rheumatism. Poultices were used and he recovered temporarily. He had similar attacks lasting only one or two days during the next few years, but last February had another attack which lasted six weeks and kept him in bed. Feeling better after this he returned to work during April and May. About the first of June the pain returned and has been constantly present since; the patient has required 3 or 4 grains of morphia during the 24 hours to obtain comfort. The diagnosis of his physician was at first lumbago, but later this was changed to "kidney trouble." He was taken to one of the hospitals of the city and operated upon, but though I visited the hospital this afternoon I was not able to see the surgeon, nor to find the history. The pain he has is across the lower third of the abdomen, extending across the flanks and up the back and sometimes down into the region of the testicle. The diagnosis upon which the operation was based was nephrolithiasis. In February he first felt a throbbing in his stomach which has increased and at times given a great deal of discomfort, causing some shortness of breath.

He was admitted four days ago, apparently in great pain. Examination shows that the heart is considerably enlarged, there is distinct heaving of the whole præcordia and over the whole heart there is a to and fro murmur with maximum intensity in the aortic region, where it has a loud blowing sound. His abdomen shows a definite heaving of the ensiform and the epigastrium, and on palpation a tumor 6 to 8 cm. in diameter can be made out, which shows pulsation of an expansile quality and a definite thrill. A bruit can be heard, but no diastolic shock on auscultation. In the right back, in the region of the 10th, 11th and 12th dorsal ribs, when the patient lies on his face, there is a distinct bulging, with a visible and palpable pulsation which at times seems to be expansile, giving the appearance of an aneurism pressing backward. The most interesting point in the physical signs is, however, that when the patient sits up the pulsation in the back entirely disappears, and in its place is seen a distinct systolic retraction. The pulse in the femorals is not markedly different from that of the radials. The patient says that after the operation referred to he was told that the trouble was "a blood tumor," whereas prior to the operation he was told that it was "kidney trouble." Evidently they made the diagnosis of aneurism at the time of operation. Our diagnosis is aneurism either of the abdominal aorta or the cœliac axis.

DISCUSSION.

DR. MCCRAE.—Some of the cases of aneurism we have seen lately have presented signs difficult to explain. This case shows signs in the back and on the right side instead of the left as might be expected and a pulsation which disappears when the patient sits up or lies flat on his face, while to the left side there is a definite systolic retraction which we usually describe as indicating adherent pericardium.

Exhibition of Two Cases of Appendicitis with Obstruction. DR. FOLLIS.

These two patients which I wish to show to-night are cases of appendicitis with obstruction, one before and one after operation. I would like to say a few words particularly about the treatment of such cases.

The first patient is a girl 15 years old, who came into the hospital May 28, 1902, with a typical history of appendicitis of three days' duration. Her attack began with nausea, vomiting, constipation, abdominal pain and tenderness. We operated and found an abscess rather far towards the middle line among the coils of small intestine. It was just the kind of a case in which one might expect obstruction from the gauze packing. The appendix was removed and a large gauze drain was packed into the site of the abscess. Patient did well for 48 hours when she developed obstruction with paroxysms of pain, vomiting and constipation. For 24 hours attempts were made to move the bowels with cathartics and enemata but this was impossible. The pulse increased in frequency gradually from 110 to 160. As her condition had become very serious she was taken to the operating room and an enterostomy was done. An incision was made

through the left rectus muscle and the first loop of distended bowel found was brought into the wound and opened immediately. At this time, I am sure we soiled the peritoneal cavity and it was with this in mind that when we had to do an enterostomy again we used the procedure which I shall describe. She did perfectly well after this operation and the foul smelling fluid bowel contents which one always finds in obstruction cases was replaced within 24 hours by normal intestinal contents. Patient did well for 18 days, at which time another obstruction occurred, although the fæcal fistula was discharging freely until 48 hours before the second obstruction. This second attack of intestinal obstruction was apparently due to the occlusion of another loop proximal to the site of the loop we had first opened. The abdomen was opened again through the right rectus muscle. This time, having in mind the soiling of the peritoneum, we used a procedure which so far as I know is new. We brought the bowel up to the abdominal wall, packed iodoform gauze around it and took some catgut sutures through the bowel, through the gauze, through the parietal peritoneum and back again. This held the bowel in place and prevented soiling of the peritoneum after it had been opened and had collapsed. After each of these operations the bowels began to move per rectum within 48 hours, which seemed to show that the obstruction was due in part at least to distension of the bowel. As soon as the distension was relieved, the obstruction was relieved enough to have normal movements of the bowels per rectum. The patient did well for about two weeks and the fistulæ began to close when she suddenly developed another obstruction after taking some indigestible food and it was necessary to open one of the enterostomy wounds. Since that time she has had no trouble and there have been no signs of obstruction. I feel sure had we tried to relieve the obstruction the patient would have succumbed.

The other patient that I wish to show is a boy who had very marked symptoms of obstruction before operation. He was sent in by Dr. Bloodgood with a history of acute abdominal pain and vomiting of 12 days' duration. Vomiting was marked from the beginning and not like that of an ordinary attack of appendicitis. Usually in appendicitis there is vomiting at the beginning of the attack which does not continue. This boy's vomiting was continuous; there were paroxysms of pain from the beginning and he was admitted in very bad condition. He had a great deal of distension, visible peristalsis and all signs of acute obstruction. In fact, the diagnosis of appendicitis was not made until the operation. We found a pelvic abscess which was opened and evacuated. The entire operation did not last over 20 minutes. We did not look for the appendix but simply brought a loop of distended bowel into the wound and sutured it in the way that I have mentioned. This was opened in three days. He made an uninterrupted recovery. His fistula and abscess wounds were closed within 30 days after the operation and he is now perfectly well. This is another case in which had we tried to relieve the obstruction or to do anything else except make an artificial anus, the patient would have surely succumbed. The symptoms of obstruction disappeared and the bowels moved per rectum within 48 hours after each enterostomy had been performed. I wish to emphasize the fact that patients with obstruction often die because too much is done at a time when they are exhausted and in a very critical condition from their obstruction. An enterostomy is indicated at this time and this method of doing the enterostomy has certain advantages over other methods which have been used.

In my first case, the first enterostomy was done by simply packing gauze about the loop of distended bowel which was brought up to the surface of the peritoneum and opened longitudinally. I feel sure there was considerable soiling of the peritoneum at this time. This was prevented in the second enterostomy by the method which I shall describe later.

In the second case, the bowel was not opened for three days as the obstruction seemed to be relieved by evacuation of the abscess. This enterostomy also healed spontaneously within three weeks.

The method in detail is as follows: A loop of distended bowel is brought up to the surface of the parietal peritoneum and iodoform gauze is packed around it to wall it off from the general peritoneal cavity, leaving a space on the surface of the bowel to be opened immediately. Catgut sutures are taken through the bowel, iodoform gauze and the parietal peritoneum at the edge of the wound and back again through gauze so that the peritoneum covering the bowel and the parietal peritoneum are brought firmly together around the edge of the wound with the gauze between them. These sutures are then tied and the bowel can be opened immediately. A stomach tube can then be introduced and the bowel washed out thoroughly both above and below the opening. The gauze is taken out in from five to six days and the granulating sinus is left to heal from below. This is not possible when a tube is sutured in the wound. If a loop of bowel is brought out as is generally done and gauze passed through its mesentery it is necessary to close it subsequently or in some cases even to resect the bowel and do an end-to-end suture. The method I have described has the following advantages:

First. When the distended loop of bowel is emptied it does not fall away from the parietal peritoneum and allow its contents to run back into the peritoneal cavity.

Second. The operation is simple and can be done quickly.

Third. The bowel can be opened immediately without danger of soiling the general peritoneal cavity as might occur if the gauze alone were used or if the bowel were sutured to the parietal peritoneum without the gauze.

Fourth. If we may judge by these cases, these enterostomy wounds close spontaneously and do not necessitate a second operation to close the bowel. In these cases the enterostomy wounds all healed within three weeks.

Fifth. It is possible to introduce a stomach tube and irrigate the bowel for some distance above and below the opening. Cathartics, stimulating and nutrient enemata can

also be given by the opening. This is not possible when a tube is sutured into the bowel, as is frequently done in these cases.

Sixth. The same procedure can be used in doing an enterostomy when operating for general peritonitis with distension.

Discussion.

Dr. Cullen.—I think Dr. Follis is to be congratulated on his success in these cases. I followed with a great deal of interest his treatment of strangulated hernia last year and the excellent results he obtained in those cases have evidently led to the adoption of a similar line of treatment in the cases of obstruction. I would like to ask Dr. Follis what will probably become of the appendix in his second case and whether any further trouble is to be anticipated. Last spring I was called in to see a boy 14 years of age giving a history of operation for appendiceal abscess three years previously. At this time the appendix was removed. He had never felt perfectly well since operation and on several occasions had elevation of temperature and was forced to remain in bed for a few days after blows over the appendiceal region. On examination I found a distinct area of induration beneath the old abdominal incision. On opening the abdomen the old site of the appendix was free from adhesions but between the cæcum and abdominal wall about 3 cm. above the appendiceal stump was a small abscess cavity.

I am not perfectly clear as to how Dr. Follis brings the gauze to the abdominal wall and would be glad if he would give us further details of his method of procedure.

Exhibition of Pathological Specimens. Dr. MacCallum.

1. Thoracic Aneurism.—The first specimen consists of the thoracic viscera of a man in whom during life the symptoms pointed definitely to the presence of an aneurism of the thoracic aorta. There was a large area of dulness extending on both sides of the median line posteriorly, intense throbbing pain throughout the back, and an area of anæsthesia in the region supplied by several of the dorsal nerves on the left side. The heart was displaced toward the right side and there was evidence of compression of the left lung. A sudden and extensive hæmoptysis resulted in the man's death.

At autopsy, the right pleural cavity was but little encroached upon, but the left was partially filled by a large mass, which lay in the posterior mediastinum and which caused extreme compression of the lung. The heart was flattened antero-posteriorly and pushed somewhat to the right, while the left lung, which was densely bound by adhesions to the ribs, was almost airless, its lower lobe being flattened out into a doughy mass about 1 cm. in thickness.

I have here the thoracic portion of the spinal column with the ribs and the contained viscera. The heart shows no especial pathological alterations but the aorta is greatly dilated and very sclerotic, even in the ascending portion of the arch. From the descending portion there opens backward, by a wide and much elongated opening, the large saccular aneurism, which is in large part filled with a thrombus mass. Below the opening of the aneurismal sac the remainder of the aorta is also very sclerotic. The sac is very intimately adherent to the vertebræ and ribs, and on tearing it away it is found that the posterior wall has been completely destroyed and the thrombus mass lies directly upon the vertebræ and ribs, which are deeply eroded in the characteristic way. The thrombus is in part friable and soft but the more central part is pinkish-white and elastic and distinctly laminated. No evidence of organization is to be found.

The left bronchus passes over the sac and is greatly compressed— a fact which probably accounts in part at least for the collapsed condition of the lung. Passing behind this and a little to the right is the œsophagus which is also much compressed by the sac and in the region of the bifurcation of the trachea there is a large hole opening into the aneurism through which the fatal hæmorrhage occurred.

2. Gummata of Liver.—The second specimen is from a negro who entered the hospital complaining of swelling of the legs and abdomen. He gave a definite history of syphilis, and during his stay in the hospital the ascites and œdema of the legs increased. At the autopsy the main interest centered in the liver, which was extremely small and distorted by contracted scars. It was found to be bound to the diaphragm by a large mass which extended through about the vena cava and invaded the lungs. On removal of these viscera together it was seen, as is still shown in the specimen, that the mass compressed the vein almost to its occlusion and that below this point the vena cava was distended throughout its course by a dark greyish-red thrombus mass which extended into the renal veins and other branches. Section of the liver shows that this large mass is composed of a homogeneous, yellowish-white material which is extremely elastic—almost like rubber in consistence, and not quite opaque. It extends some way into the liver, but there are also many other smaller masses of the same nature scattered through the organ and surrounded by radiating scars. These are without doubt gummata and in the elastic condition which gave origin to the name gumma or rubbery tumor. Similar masses occur in the retroperitoneal and peritracheal glands and spleen. Besides these masses in the liver with their associated scars, there is a diffuse cirrhosis, which shows microscopically a quite extensive degeneration of the liver cells with some attempts at regeneration.

The thrombus in the vena cava shows a beginning organization but it is apparently of long standing—no doubt the œdema of the legs was primarily caused by the compression of the vein to which the occlusion by the thrombus was added later.

3. Thrombus.—The third specimen also shows the result of occlusion of a vessel by a thrombus mass. It consists of the heart together with the cervical and axillary veins and the aorta of a person who had been a patient in this hospital for several years with symptoms of mitral stenosis and occasional evidences of the stoppage of a vessel. At one time there

lodged an embolus in the popliteal artery, at another the jugular vein became thrombosed and cord-like. Finally, with a sudden severe pain, with lividity of the legs and abdomen and some paresis in both legs, she died. At the autopsy it was found, as you see in this specimen, that beside the extreme mitral stenosis, there was a tricuspid stenosis of almost as high grade. The aortic valves were also thickened and contracted, producing, no doubt, an aortic insufficiency as well as stenosis. There was no thrombus in the heart except a small one in the left auricular appendage. The left jugular, when dissected out, was found to be converted into a fibrous cord with several narrow canals from which fluid blood could be squeezed. The same condition was found to exist in the left subclavian vein.

One can see in the sections which I have placed under the microscope that in this fibrous cord we have really the original vein wall distended by a fibrous mass which no longer contains any thrombus but which is perforated by a great number of wide, irregular canals lined by a single layer of endothelium only. Besides these there are well defined small arteries and veins crossing through the tissue. It seems possible that the large irregular channels may have arisen as clefts in the thrombus later lined by an overgrowth of endothelium from the main vessel, while the other vascular channels have arisen from the vasa vasorum.

As indicated by the pain and lividity in the legs, the abdominal aorta was completely occluded by a thrombus, which extended from a point about 3 cm. above the bifurcation, down to Poupart's ligament on both sides. In the left femoral artery the thrombus was old and partly organized but otherwise it was not possible to determine exactly the starting point for the occlusion of the aorta. The last two lumbar arteries are included in the thrombus and, as you will recall, there was slight paresis of the legs, but although the question of paralysis after occlusion of the abdominal aorta is of great interest, since the experimental work in rabbits in which occlusion of the abdominal aorta is produced after an hour's paralysis of the legs, we were not able to examine the spinal cord.

Dr. Welch reviews the subject in his paper in Albutt's System of Medicine and regrets that of fifty-seven autopsies on such cases, in only one was there any microscopical examination of the cord. In that case there was a degeneration of the anterior and posterior nerve roots.

DISCUSSION.

DR. MCCRAE.—These cases clinically were all of very great interest. The one of occlusion of the inferior vena cava hardly seemed to give the view that the change in the vessel accounted for all the symptoms. The swelling of the abdomen and œdema of the legs dated back too far and was probably due to cirrhosis of the liver. The last case reported was of exceeding interest with reference to the diagnosis of the tricuspid disease. The presystolic murmur was heard always over a wide area but there were no special signs in the veins of the neck or about the lungs and a clear diagnosis was not made. There seemed little question during life as to the diagnosis of embolism in the artery of the leg and the sudden onset of great pain and coolness of the leg confirmed the diagnosis.

Report of Gynecological Cases. DR. CULLEN.

This evening I wish to briefly report four rare cases of uterine myomata which we have seen in the course of the last few months.

CASE 1.—*A large myomatous uterus with a subperitoneal nodule molded to and filling the pelvis. Strangulated umbilical hernia. Removal of hernial sac. Hystero-myomectomy. Recovery.*

Mrs. F., seen in consultation with Dr. Scherzer on August 10, 1902. The patient had noticed an abdominal tumor for several years and had also complained of an umbilical hernia. The hernia came down occasionally but was reduced with ease. On August 11 it protruded and it was impossible to return it. When I saw her the pulse and temperature were perfectly normal but at the umbilicus there was a reddened area fully 5 cm. in diameter and surrounded by a zone of induration fully 15 cm. across. The tissues here were markedly œdematous and it looked as if the skin would soon become necrotic. On palpation a large mass could be felt filling almost the entire abdomen. Above it extended to a point midway between the umbilicus and zyphoid cartilage. On vaginal examination the entire pelvis was found to be filled with a hard myomatous mass. Immediate operation was advised. Fearing infection we completely isolated the indurated area around the umbilicus by stitching gauze over it. An elliptical incision was made, removing the entire indurated area. The sac was found to contain nothing but omentum. This, however, was deep red in color and would soon have become necrotic. The large tumor filling the abdomen and pelvis proved to be a myoma. The main tumor was liberated with little difficulty, but projecting from the posterior surface of the myoma was a large secondary myomatous growth which filled the pelvis completely and was molded to the pelvis. It was impossible to liberate this growth until the uterus had been completely freed from its cervical attachment. The patient made an uninterrupted recovery. When I saw her on November 3 she was in excellent health.

This specimen is particularly interesting from the subperitoneal myoma conforming so definitely to the outline of the pelvis.

CASE 2.—*Myomatous uterus, very large pedunculated submucous myoma filling vagina, also with a large subperitoneal nodule adherent to the right ureter and blood-vessels at the pelvic brim. Complete hysteromyomectomy with great difficulty in delivering the submucous myoma per abdomen. Accidental temporary ligation of the right ureter. Recovery.*

Miss R., seen in consultation with Dr. F. Gavin on October 24. The patient was 46 years of age. She menstruated at 13 and has always been regular. For the last five years the

menstrual periods have been prolonged and profuse and there has been some leucorrhœa. About this time she felt a small nodule the size of a walnut in the lower abdomen. At present she is very anæmic, constipation which has always troubled her has been more severe during the last year and for three years there has been frequently painful micturition. On abdominal examination distinct bosses can be felt rising to the pelvic brim and on vaginal examination a large mass, the exact dimensions of which cannot be determined, fills the vagina. This mass appears to be about the size of a cocoanut.

Operation October 25: A median abdominal incision was made, extending almost from the umbilicus to the pubes. A myomatous uterus was found. The greater part of the mass extended below the cervix. The left tube and ovary were tied off and then the round ligament secured. The right side was treated in the same manner but here a subperitoneal myoma about 5 cm. in length and irregular in outline was found. This lay along the course of the iliac vessels and was intimately adherent over the site of the ureter. Its attachment to the uterus was by a muscular pedicle 5 mm. in thickness. We severed this subperitoneal myoma from the uterus and left it *in situ* as its removal at this stage of the operation was impossible. The uterus was drawn still further upward, the bladder was pushed down until the vagina was exposed. The vagina anteriorly was drawn up between two pairs of artery forceps and cut between. Once in the vagina, which by the way was greatly drawn out and distended by the submucous myoma, we were enabled to cut under sight from before backward and in a short time had the uterus and the vaginal cuff entirely free. On making traction, however, it was impossible to dislodge the submucous myoma which filled up the entire vagina and was attached to the uterus by a pedicle fully 2.5 cm. in diameter, but after making gentle but steady traction and pressing downward upon the bladder the myoma was dislodged with a loud sucking sound. Had we not been able to liberate it in this way we should certainly have applied obstetrical forceps. Attention was now turned to the myoma in the right side and to the right tube and ovary. The peritoneum over the myoma was split, and the myoma pealed out as gently as possible. In the meantime, however, we found it necessary to control the right ovarian vessels. This was somewhat difficult. After removing the myoma we examined the right ureter and found it included in the stump with the ovarian vessels. The vessels were picked up, the previous sutures cut and the ureter liberated. The raw surfaces on the vaginal margin were controlled with catgut and the opening in the vaginal vault narrowed down until it was about 2.5 cm. in breadth. A gauze drain was laid up to the brim of the pelvis on the right side to catch any urine should extravasation take place from the previously constricted ureter. This gauze of course was covered over with peritoneum and was accordingly extraperitoneal. Another piece of gauze was dropped down into Douglas's sac as a safeguard should there be any slight sepsis, as it was impossible to thoroughly cleanse the vagina prior to operation. The patient stood the operation well.[1]

In this case one naturally asks why was not the large submucous myoma removed per vaginam prior to the hysterectomy? In the first place, the patient was an unmarried woman and removal in such a manner was almost out of the question without first making a deep incision in the vaginal wall. In the second place the bleeding was so free during the slightest manipulation that we hesitated to give the necessary cleaning.

The situation of the ureter in this case was of especial interest as it was far out of position and right up beside the ovarian vessels. We only had a narrow chink of about 8 mm. in breadth in which to tie the ovarian vessels and it was impossible to control them in any other situation.

CASE 3.—*A partially parasitic myoma receiving its blood supply chiefly from the enlarged omental vessels and a densely adherent bladder. Also associated with over 50 litres of ascitic fluid and clinically presenting the typical picture of a patient suffering from a tremendous ovarian cyst. Removal of parasitic myoma. Recovery.*

Miss P., referred to me October, 1902, by Dr. Hopkins. The patient is 54 years of age, very thin and has the typical expression of one suffering from an ovarian cyst. For several years she has been complaining of abdominal distension. The abdomen is greatly enlarged, and in the lower portion near the pubes there is much œdema. There is, however, little or no swelling of the extremities. The entire abdomen is dull on percussion but in the flanks there is some tympany. On palpation a slight wave of fluctuation can be elicited. I saw this patient several days ago but on account of a recent bronchitis operation was deferred. We, however, thought it advisable to tap, and over 39 litres of clear straw-colored fluid were removed.

Operation October 29: On opening the abdomen we obtained at least 15 litres more of free fluid, the peritoneum was thickened, the intestines were of the normal color and lying immediately beneath the incision was a globular tumor at least 16 cm. in diameter. Above the omentum was practically missing but the omental vessels had become greatly enlarged and had grown into the posterior surface of the tumor. These vessels had exceedingly delicate walls and were surrounded by little connective tissue. So friable were they that the slightest traction was sufficient to rupture arteries at least 3 or 4 mm. in diameter. The omental vessels were tied off and the tumor delivered. It proved to be a subperitoneal myoma which had become partly parasitic. It was attached to a practically normal uterus by a pedicle 4 cm. broad and 1 cm. thick. It was densely adherent to the parietal wall of the left side and anteriorly was intimately attached to the bladder from which it had received an abundant blood supply. In order to release the bladder it was necessary to sever the pedicle of the myoma and to turn it downward over the symphysis, making the point of cleavage

[1] The patient left the hospital November 29, 1902, feeling perfectly well.

on the posterior surface. Much bleeding took place but was readily controlled. The stump at the fundus was turned in by catgut sutures. The patient made an uninterrupted recovery.

In this case we had the typical facial expression of a patient suffering from an ovarian cyst. Furthermore, we found dulness in front as we would naturally expect with a multilocular cyst and also noted tympany in the flanks. In the first place the dulness was undoubtedly due in part to the omental vessels and the myoma together, forming a barrier to the intestines floating upward, and in the second place the distension was so great that the mesentery was not long enough to allow the intestines to reach the surface. The fact that the intestines were held back naturally accounts for the tympany in the flanks. The association of ascitic fluid with the presence of uterine myomata is most exceptional. In this case it was probably due to the twisting of the omental vessels by the freely movable myomatous growth.

CASE 4.—*Removal of a large interstitial and partly submucous myoma. Subsequent sloughing of inner layers of uterine walls, removal of necrotic tissue followed by recovery.*

The patient, who was 38 years of age, was admitted to the Hebrew Hospital on July 14, 1902. She had noted a pelvic tumor for some years, but it gave her little concern until pressure symptoms manifested themselves and she came complaining of swollen legs which were dark purple in color. The urine showed a considerable quantity of albumin. We removed a large interstitial and partially submucous myoma nearly the size of an adult head. The uterine cavity was opened in several places. After operation she did well for several days, then her temperature rose two or three degrees and she had some headache and much nausea. The urine contained quantities of epithelial and blood casts. At the end of fifteen days there was a most offensive vaginal discharge. We examined under anæsthesia and found pus oozing from the cervix. The posterior lip of the cervix was then split to obtain free drainage and we removed fully a large handful of necrotic tissue from the interior of the uterus. Its removal did not occasion any hæmorrhage and the necrotic material was evidently sloughing uterine tissue. In this case we had stitched the uterus to the anterior abdominal wall. Consequently the line of incision was protected. Otherwise we would undoubtedly have had separation of the muscular walls with escape of purulent material into the abdominal cavity. The necrotic process apparently occupied both the anterior and posterior walls.

This is a most rare complication and the first that we have seen.

I saw this patient a few days ago and she is in good health.

November 17, 1902.

The meeting was called to order by the president, Dr. Williams.

Certain Forms of Cyanosis with Polycythæmia. DR. OSLER.

Cyanosis is of course a very common condition in hospital work. We see it in heart cases, the congenital form, and a certain number of cases of acquired mitral disease in children. Then there is an interesting group, the next most frequent that is connected with pulmonary diseases, in acute miliary tuberculosis, in pneumonia, but above all in emphysema, in which it may be most extreme, and a patient will actually frighten you by his appearance as he walks into your room. It is seen in Reynaud's disease but only about the extremities. There is a class of cases in which the cause is very obscure. Some of you remember the patient seen last winter, with abscess of the liver, on whom the impress of the hand remained for half a minute and then gradually disappeared. I have lately had under observation two cases of this obscure superficial cyanosis.

This man has been in the hospital on four occasions, each time with a history of nausea and vomiting, both of a persistant character, constipation and a remarkable grade of cyanosis. He is not nearly so bad now as he has been, but you can see that the lips are quite cyanosed and so is the general surface of the body. The cyanosis gradually disappears as he gets better but it never entirely goes. Associated with this there is a very remarkable blood condition. On each admission he has had an extraordinarily high blood count, reaching, on May 10, 10,200,000 per cubic millimeter, with a hæmoglobin as high as 115 but no change in the leucocytes. His blood pressure was 142 mm.

The second case I have under observation is in a man whose appearance at once attracts attention. His face is a livid hue, almost an indigo blue, and his hands always engorged and cyanosed. His blood count was a few weeks ago 10,000,000 per cubic millimeter. Has a slight trace of albumen and a few tube casts but his general condition is good. On very cold or moist days he gets a little stuffiness in the bronchial tubes.

This rare condition has been referred to by Dr. Cabot of Boston and Dr. Saunders of Birmingham.

An Interesting Case of Paraplegia with Recklinghausen's Disease. DR. THOMAS.

To appear later.

DISCUSSION.

DR. OSLER.—An interesting point in these cases relates to the prognosis. In a case which has been under observation at intervals for eight or nine years with not more than a dozen patches over the body, and much of pigment there has been also the commonly associated condition of slight failure of mental powers. Has that been noted in this case?

DR. THOMAS.—There is evident mental failure.

Rectal Surgery. Illustrated with Stereopticon. DR. BALL, of Dublin.

The Clinical Value of Blood Pressure Observations in Regulating Stimulation in Sick Children. DR. COOK.

See February BULLETIN, 1903, page 37.

Some Observations on Blood Pressure in Morbid Conditions in Adults. Dr. Briggs.

See February Bulletin, 1903, page 35.

Discussion.

Dr. Crile (of Cleveland, Ohio).—The work reported by Dr. Cook and Dr. Briggs seems to me to be of great importance. In many cases the record of the blood pressure by means of a thermometer is of as much or more importance than that of the pulse rate or temperature or respiration, notably in cases of shock, of infection, and of renal diseases. In my experience the Riva-Rocci-Cushing instrument is the most practical. Regulating the administration of certain drugs by their effects upon the blood pressure appears to be a matter of much importance. These valuable papers strongly indicate the usefulness of this new means of clinical precision.

Dr. McCrae.—I would like to express my appreciation also of this excellent work. In the medical department we are endeavoring now to obtain as large a series of observations as possible and I have been impressed by the importance of these in relation to the treatment. What Dr. Briggs has observed in regard to stimulation seems to support the ideas arrived at clinically some years ago, namely, that strychnia where it is required is usually required in large doses and for the last few years we have not hesitated to give a tenth of a grain and repeat it within an hour if necessary. In regard to digitalin we have been using it more and more for stimulation of the circulation and just as steadily during the last two years have been discarding salt solution as a stimulant. These points were arrived at by practical observation and are now being endorsed by accurate measurements.

Dr. Cushing.—Dr. Briggs and Dr. Cook are to be heartily congratulated on the results of the work which they have however only in part presented. I do not know that the Society is aware of what an immense amount of time it has been necessary to devote to this subject in order to obtain the data which have been given. It is necessary always when making early observations of this kind to do more than double the amount of work which will later be required, in order to establish those conditions in which the procedure may be of practical importance. Heretofore, the reports coming from those who have interested themselves in blood pressure observations have given a little more than isolated observations of the arterial tension in different clinical conditions. The method of plotting the records in some conformity with the clinical plotted charts on temperature and pulse rate is, I think, entirely new and enables one to graphically represent alterations in the blood pressure and so interpret them as is possible under no other circumstances. These gentlemen have this evening limited themselves to questions of stimulation, although they have worked out in addition a great many more problems of physiological interest than their present brief reports would indicate. On the surgical side of the hospital there has been a long-felt want for some form of apparatus by means of which repeated observations on blood pressure might be taken during serious operations. We have had heretofore to rely simply upon the pulse rate and upon the general character of the pulse as interpreted by the anæsthetist and, as has been emphasized to-night, pulse rate may be a very poor indication of the patient's condition. The apparatus itself, which has been considerably improved and made more portable by Dr. Cook's suggestions, possibly still leaves something to be desired. Our confrères, the physiologists, have shown us that it is in some respects an inaccurate form of pressure apparatus and consequently what we must do by means of these rough observations is to point out those groups of cases in which blood pressure observations are especially valuable and in which it might be advisable in consequence to utilize the more elaborate form of apparatus, giving both systolic and diastolic pressure, in order to give results of greater reliability. I do not wish to belittle the necessity of educating one's fingers as a means of estimating arterial tension, but in all serious conditions the desirability of employing an instrument of precision need not be discussed. It may be said also, in passing, that the employment of such an apparatus is more helpful in training the fingers for the proper appreciation of arterial tension than any amount of practice gained without the confirmation of the numerical data which the apparatus furnishes. There was a time when the patient's temperature was estimated by applying the hand to his forehead but what one desires to know are the slight variations in temperature which the clinical thermometer alone can give. Just so is it possible to tell whether a patient has a "bounding" or a "feeble" pulse, but what one wishes to know are its alterations from moment to moment or hour to hour under the multitude of conditions both therapeutic, as emphasized by these papers this evening, and otherwise, this information can only be gained by the employment of some form of blood pressure apparatus and the more simple it is the more readily it can be adapted to the requirements of bedside and operating table. Dr. Cook's relation of the method of stimulating children, entirely dependent upon the blood pressure observations made by an attending nurse, are most interesting and of great practical value. I wish once more to congratulate these gentlemen, not only upon their results, but upon the great perseverance which they have shown in obtaining them.

December 1, 1902.

The meeting was called to order by the president, Dr. J. Whitridge Williams.

Exhibition of a Case of Uncinaria. Dr. Boggs.

To appear later.

Discussion.

Dr. Futcher.—Just after Dr. Stiles' original communication on this American type of uncinaria appeared, Dr Harris, of Atlanta, Georgia, reported a case of uncinariasis which he thought was due to the old world species, but Dr. Stiles later demonstrated that the infection was due

to the American type of the parasite. Since then, Dr. Harris has been making observations on the frequency of uncinariasis in Georgia, and in *American Medicine*, of November 15, he reported that he had observed 13 cases during the summer. He believes this organism to be the commonest cause of the severe anæmias occurring in the southern states and that it is a much more frequent cause of anæmia than is malaria. Dr. Guiteras has just reported some cases from Havana and the disease is known to prevail in Porto Rico. Dr. Herrick, who was recently an interne here, has reported a case that occurred in the Soldiers' Home, Washington. Uncinariasis is known to be one of the conditions in which eosinophilia occurs, and in this case it was as high as 26 per cent.

Adenomyomata of the Uterus. DR. CULLEN.

Abstract to appear later.

December 15, 1902.

In the absence of the president, the meeting was called to order by Dr. Randolph.

Exhibition of Renal and Ureteral Cases. DR. YOUNG.

I wish to report to-night seven recent cases of renal and ureteral diseases upon which I have operated.

CASE I.—Calculus of lower end of left ureter with stricture below it. Extraperitoneal iliac ureterolithotomy, and intravesical division of stricture.

The first is a man, aged 29, who came to me August 28, 1901, with the history that since the age of two years he had suffered with indefinite but constant pain in the region of the bladder, on the left side, and occasionally in the region of the left kidney. Every two or three weeks he had sharp attacks of pain on that side which would radiate from the bladder upwards to the left kidney. These symptoms continued up to the time I saw him. On examination I found his urine to be clear and without shreds or pus. A week later, after a sharp attack of pain, there were numerous red blood corpuscles in the urine. Examination showed the bladder to be normal. The orifice of the right ureter was normal in appearance. The orifice of the left ureter was contracted and situated in a cone-like projection of mucous membrane. To the outer side of this the ureteral ridge was replaced by a bulging prominence of mucous membrane. The ureteral catheter obtained clear healthy urine from the right kidney, but could only be passed for about one cm. up to the left ureter when it met an obstruction, and it was impossible to get any urine from this side. The diagnosis of a stone impacted in the terminal portion of the left ureter accompanied by stricture of the ureter was made. X-ray pictures were taken and showed a calculus about the size of the thumb at the lower end of the ureter where it entered the bladder. Extraperitoneal extraction of the calculus was decided on. An incision was made corresponding to the lower two-thirds of Israel's incision. I can show the incision of this patient here (showing patient), which is a more recent case, and in which the wound shows a little more clearly.

The incision was carried rapidly through the skin and muscles until the peritoneum was reached, which was stripped up from the iliac fossa and the vessels exposed. Search was then made for the ureter, which was finally found very greatly dilated, about one inch in diameter, and so intimately incorporated with the peritoneum that it was very difficult to find it. It was freed by blunt dissection to its vesical end, and there a large calculus was felt impacted partly within the intramural course of the ureter, and partly above it. The calculus was freed by the finger and pushed upward into the ureter to a point about the pelvic brim, where the ureter could be easily reached. Using the stone as a bobbin several mattress sutures of fine silk were placed in the ureter, which was then opened and the stone removed. The stone, as you see here, was oval in shape, about 2 cm. long and 1½ cm. in diameter. Its surface shows broad furrows which have been made by the urine flowing by it. Before closing the ureter a Kelly bulbous ureteral dilator was passed from the ureter and a tight stricture of its intramural portion just beyond the location of the calculus was discovered. All efforts to pass small catheters and probes were unavailing. It was then determined to divide the stricture from within the bladder. For this purpose the bladder was drawn over into the iliac wound, the vas deferens stripped backward from its lateral wall, which was then opened extraperitoneally. After evacuating the bladder the end of the left ureter could be easily seen. The orifice was very small and surrounded by a small bulging ring. With the end of the index finger of the left hand pressing against the orifice of the ureter, I finally, by considerable force, pushed the end of the smallest dilator through the stricture until it appeared in the bladder, but was unable to push it further. A scalpel was therefore inserted into the bladder and the stricture divided by cutting along the instrument within the ureter. The stricture was found to be about 4 mm. thick and extremely fibrous. After its division the largest bougies passed into the bladder. The wound which had been made in the left lateral wall of the bladder was then sutured with about eight interrupted catgut sutures. The ureter was closed with fine silk which had been previously put in position. The abdominal wall was closed with buried silver wire sutures, leaving a small place for drainage near the lower end. The patient had an uninterrupted convalescence. Neither the ureteral or vesical wounds leaked, and now, one year after the operation, he is perfectly well, and the cystoscope shows that the orifice of the left ureter has not contracted, but remains in the shape of a slit.

CASE II.—Calculus impacted in juxta-vesical portion of right ureter. Detection by ureteral catheter and X-ray. Extraction by extraperitoneal ureterotomy.

This second case is very similar to the preceding. The patient, a male, aged 25 years, with a negative past history, had, for the first time 5 years ago, a sharp cramping pain in the region of the right kidney. This lasted for six hours,

when it was relieved by a large dose of morphia. The patient was nauseated and vomited, but there was no hematuria. During the next two weeks patient had two similar attacks, but after that had no recurrence for three years. In December, 1900, the attacks began again and recurred at intervals of about one month. In these the pain was not localized in the region of the right kidney, but always began in the testicle, and from there radiated to the right kidney. In March, 1901, bloody urine was noticed for the first time, and two weeks later a small calculus was passed. After that the patient was free from symptoms for six months, when the old symptoms returned and have recurred about every two weeks up to the present time. When he came to me he complained of a more or less constant dull pain deep down in his pelvis. The physical examination was negative; the urine contained only a few shreds. The cystoscope showed a normal bladder with both ureteral orifices functioning normally. The ureter catheter was passed into the right ureter, but after going a distance of about 4 cm. an obstruction was met with which could not be passed. It was possible, however, to collect urine from this side, and it was found to be of very low specific gravity and contained very little urea. An X-ray photograph was taken and a small shadow found in the region of the right ureter just back of the bladder. Another photograph, taken with the bladder filled with a suspension of bismuth, showed that the calculus was about 2 cm. above the bladder. In September, 1902, the calculus was removed through an extraperitoneal iliac incision, as in the last case. The ureter was about the size of the little finger and very closely adherent to the peritoneum. The stone was tightly impacted at a point about 1½ cm. above the bladder, but was finally dislodged, pushed upward in the ureter and removed as in Case I. Small bougies passed into the ureter detected a stricture below the site of the calculus, but it was impossible by slight pressure to dilate the stricture, several successive instruments being passed into the bladder, fully dilating the ureter. The ureter was sutured as before, and the patient made an uninterrupted recovery. There was no leakage from the ureteral wound. The patient is now in perfect health. Urine normal.

Case III.—Chronic sinus beneath 12th rib on left side, supposed to be due to necrosis of rib. Cystoscope showed the left ureter not functioning, its orifice contracted. Five stones shown in left kidney by X-ray. Operation: nephrectomy.

This patient, a young man, aged 21, came to me complaining of a fistula in the back, which had been present for some years, and which was supposed to be due to necrosis of the 12th rib, for which he had undergone several surgical operations. His history, however, was as follows: At the age of 4 he had pain in the left side associated with swelling. After a few days this passed away, but a little later he had another attack, and during the next 5 years this intermittent pain and swelling in the left side came on at frequent intervals. At the age of 10 he had for a month considerable irritation of the bladder associated with frequency of urination. He passed no blood or calculus, however, and since then has never had any bladder trouble. During the next 5 years he suffered frequently from intermittent attacks of pain in the left side beneath the ribs, which were sometimes associated with nausea, but never radiated to the bladder. In 1897 an abscess formed in the left side, which was opened by a physician and a large amount of pus evacuated. Since then he has had a fistula which has secreted a small amount of pus, but never any urine. He has been operated on twice for his fistula, which was supposed to be due to necrosis of the rib or spine, but which has not been benefited by the operations. At present the patient has a dull aching pain referred to the left sacro-iliac synchondrosis, but not in the region of the fistula or beneath the ribs. Urine is voided normally and there is no vesical irritation. The fistula in the left side secretes only a small amount of white fluid daily. On physical examination the right kidney was found to be larger than normal and fairly movable. On the left side the kidney could be felt and there is no tenderness beneath the ribs. Just beneath the tip of the 12th rib on the left side there was a scar, in the middle of which was a small fistulous opening in which a probe passed upward and inward for a distance of about 5 cm. No exposed bone could be felt. Examination of the spinal column was negative. Genitalia normal. Urine clear, microscopically negative. Cystoscopic examination: the bladder mucosa was normal; the right ureteral orifice was large and functioning regularly, the ureteral ridge well marked; on the left side the orifice small, the ureteral ridge is not present, and the ureter is not functioning. The diagnosis of blocking of the left ureter of long standing was made at once.

An X-ray picture was taken and showed the shadows of 5 calculi in the region of the left kidney. On October 28, an extraperitoneal lumbar nephrectomy was performed. The left kidney was found higher up beneath the ribs and closely adherent to the diaphragm above, and the vertebræ within. It was surrounded by a very dense capsule. The 12th rib had to be resected, and even then the kidney was removed with great difficulty. It was small, measuring 3 x 4 x 5 cm. in size. The cortex was almost entirely replaced by fibrous tissue which formed a sac for the five stones which it contained. The wound was closed with a small drain, and the patient made an uninterrupted recovery. It is now six weeks after the operation and he is ready to go home. His urine is clear.

Case IV.—Dull aching pain for 10 years in left side. Cystoscopic examination: pus coming from the left ureter. Radiograph negative. Left lumbar nephrectomy. Dense fibrous capsule one inch thick surrounding the kidney, and several calculi.

This case, a male aged 38, had a history of pain in the left side which began about 10 years ago, and which has been more or less continuous ever since. It has always been dull in character, has never simulated renal colic, and no calculus has ever been passed. Urine has been cloudy for several years. He had suffered considerably with night sweats,

and lost 15 pounds in the last year. There has been no vesical irritation. On examination an indurated mass was to be felt in the region of the left kidney, but was not tender on pressure. The cystoscope showed the right ureteral orifice to be normal and emitting clear urine. The left ureteral orifice was surrounded by swollen reddened mucous membrane, and from it there escaped a string of muco-pus. The ureteral catheter obtained clear urine from the right kidney, but on the left side an obstruction was met with, about 4 cm. above the orifice, and no urine could be obtained. The urine contained pus but no bacteria. Numerous attempts to find tuberculosis were negative.

Several radiographs were taken, but no calculus was detected in the region of the left kidney or ureter. Tuberculin was administered, but no reaction was obtained.

It was impossible to make a positive diagnosis. The symptoms suggested tuberculosis, and the failure to find a calculus by X-ray seemed to support this. It was impossible, however, to find tubercle bacilli, and the tuberculin test was negative. On November 25, the kidney was exposed through an incision in the left lumbar region. It was found to be surrounded by an exceedingly dense, thick, fibrous capsule, in places 1 inch thick.

After cutting through the capsule a large pyonephrotic kidney containing several large stones was exposed and finally enucleated and removed with the ureter, which was divided just at its vesical juncture.

The wound was closed with drainage, and the patient has made an uninterrupted recovery. His urine is now clear and contains only a few shreds.

CASE V.—Symptoms of calculus in right kidney for 23 years. Pain in left kidney for one week. Pus obtained from both sides by ureteral catheterization. Large calculus in both kidneys demonstrated by X-ray. Right lumbar nephrolithotomy.

This patient, a male, aged 42, had first a severe attack of pain in the right lumbar region 23 years ago. After that he had intermittent attacks of pain almost every day, often slight and of short duration, but frequently severe, and running down to the right groin. During the past 2 years the severe attacks occurred every 4 to 5 weeks. He never passed a calculus, and had never seen any blood in his urine. When first seen he had an acute cystitis and urethritis in which no bacteria could be found. During the following week he had four attacks, one of which was very severe, and localized in the left groin and back. Patient has improved by a week's use of urotropin. Ten days after admission the urethra still contained pus, but no bacteria could be found. Urine was cloudy in all three glasses. The prostate was indurated and the right seminal vesicle contained two hard nodules which felt like calculi. During the next week the patient began to have a dull aching pain on the left side which finally became more severe than that on the right. He had never before had any pain on the left side. Urine was still very cloudy with pus, but as the urethral discharge had largely disappeared catheterization of the ureters was performed and purulent urine was obtained from both sides.

The percentage of urea was low in both specimens. There were no bacteria to be found in either. An X-ray picture was taken, and showed a large shadow in each kidney. The diagnosis of bilateral renal calculus and pyonephrosis was made.

REMARKS.—The patient was secreting only about 10 grams of urea daily, and on forced diet this amount was not increased, and it was evident that both kidneys were considerably diseased. The continuance of severe pain rendered an operation necessary, and it was therefore decided to remove the calculus from the right ureter first, and to wait until a later date to remove that from the left. On November 20, under ether, the right kidney was exposed extraperitoneally through the lumbar incision. The fatty capsule was not thickened or adherent. The kidney was larger than normal, and in places lobulated and considerably congested. In the pelvis a large stone could be felt. A small incision was made along the outer border, a forceps pushed through the cortex into the pelvis, and the blades separated, thus making a wound through which the calculus was extracted. This calculus measured about $1\frac{1}{2} \times 1 \times 1$ inches. About 25 small calculi were afterward removed with a spoon. Some of these were typical jack-stone calculi with long branches from a slender body. The kidney wound was closed around the large drainage as usual. There was very little hemorrhage and absolutely no shock following the operation, and the patient made an uninterrupted recovery. The use of the rubber tube to drain the pelvis of the kidney proved an excellent scheme, as it prevented a collection of blood-cot in the pelvis of the kidney. The patient was much freer from pain than in cases in which the kidney was closed without drainage. The patient is now going about and feels perfectly well. His urine is still loaded with pus, but he is free from pain. He has had no symptoms from the calculus in the left kidney since the operation. He will be watched closely and in a month or two when he has fully recovered from the last operation the calculus will be removed from the left kidney.

CASE VI.—Intermittent attacks of renal colic on the left side for 3 years. Stricture of the lower end of the left ureter, impermeable to the catheter. Right ureter and kidney normal. Tubercle bacilli in urine. Nephro-ureterectomy.

This patient was a male, aged 35, who complained of pain in his left side and back. Three years ago he was taken with a severe pain in the left lumbar region which radiated into the bladder and to the glans penis. The pain was extremely severe and lasted about $\frac{1}{2}$ hour. After that he had similar attacks about twice a week, but never passed any blood or calculus. At times he had fever and night sweats; he suffered a great deal, but never lost any weight. When seen by me his urine contained a great deal of pus in which tubercle bacilli were present. There was no tenderness in the region of the left kidney or ureter.

The cystoscope showed a healthy bladder with the exception of the left ureteral orifice, which was obscured by several polypoid-like projections of mucous membrane which surrounded its orifice. The adjacent mucosa was considerably injected. The right ureteral orifice was normal, and a ureteral catheter was easily inserted and clear urine withdrawn. Attempts were made to catheterize the left ureter, but it was impossible to get the catheter to enter, probably owing to a stricture at the orifice. On October 1, an extraperitoneal nephro-ureterectomy was performed. At the time of operation tubercle bacilli had not been found in the urine, and no positive diagnosis had been made, and the ureter which was first exposed was found to be the size of a lead pencil, and its walls greatly thickened. Suspecting calculus of the lower end, the ureter was followed down to its vesical juncture, but no calculus was found. The kidney was then exposed and was found to be enlarged and lobulated and so definitely diseased that I decided to remove it without cutting into it for diagnosis. The kidney with the entire ureter down to about 1 inch of the bladder was removed in one piece. The muscular wound was closed with two places for drainage, and the patient made an uninterrupted recovery.

An examination of the specimen after removal showed miliary tuberculosis of the pelvis, several small portions of the cortex and the entire ureter. Another search was made for tubercle bacilli in the urine passed just before operation and they were found present. This case was particularly interesting on account of the fact that the history suggested calculus much more than tuberculosis.

Case VII.—Extensive pyonephrosis of left kidney of eight years' duration following typhoid fever. Typhoid bacillus present in pure culture. Catheterization of ureters. Right kidney healthy. Extraperitoneal nephrectomy. Cure.

This patient, male, aged 44, presented himself with a tremendous pus kidney upon the left side, which had begun after an attack of typhoid fever eight years previous. From his urine pure cultures of the typhoid bacillus were obtained.

As it is our intention to make an extensive report on this case elsewhere, I shall only show the specimen which was removed.

As you see from this specimen, the kidney and its pelvis were greatly dilated, forming a sac which contained about a quart of pus. The kidney was surrounded by a very dense capsule and about 1 inch thick. Imbedded in one portion of the cortex was one large calculus. The X-ray picture had failed to show this, probably owing, as in Case IV, to the very thick dense capsule which cast a shadow and obscured the calculi. It was impossible to remove this capsule owing to dense adhesions to the peritoneum and surrounding structures, and intracapsular enucleation was performed.

When the pedicle was reached a circumcision of the capsule at the hilus was performed, which gave an opportunity to isolate the vessels of the pedicle and ligate them before division. The abdominal wound was closed with small places for drainage, and the patient made an uninterrupted recovery. His urine is clear.

Dilated Ureter with Protrusion of Bladder Wall. Dr. Hunner.

Dr. Hunner reported briefly a case of dilated ureter causing a protrusion of the bladder wall. A full report will appear in the Bulletin.

Discussion.

Dr. Young.—Dr. Hunner's case is interesting. I have had only one similar. In this case during a cystoscopic examination a small rounded tumor was seen in the left half of the base of the bladder. Thinking that it was a neoplasm, I began to study it carefully, when it suddenly disappeared, much to my surprise. In a few seconds it again sprang into view and from its apex came a fine stream of urine, which continued to flow for several seconds, when the tumor again collapsed and remained so until the next peristaltic ejection of urine ballooned it. A suprapubic cystotomy showed that a tight stricture of the end of the ureter, with a small globular dilatation of the intramural portion of the tube was present.

I may say regarding the literature of these cases that these two cases of calculus which I have reported make the eighth and ninth cases of calculus of the lower end of the ureter in the male that have been operated on. Six cases have been operated upon abroad and three in this country, one by Dr. Finney, of stricture of the lower end of the ureter, and only three cases have been operated upon except by dilatation with bougies. One case was that of Meyer, who finding such a stricture, took out the kidney and ureter. The second case is that of Israel, who cut off the ureter and transplanted it into the vertex of the bladder. As far as I can find, my case is the only one operated on leaving the ureter *in situ*. The patient is in good condition and the orifice has not contracted. This procedure which I have called intravesical ureterotomy through the iliac extraperitoneal incision is not a difficult one, and is much preferable to transplantation of the ureter.

Dr. Hunner.—I would like to ask if any cultures were made in the case which had typhoid fever?

Dr. Young.—I did not go into that point because we intended to bring that out later, but cultures were obtained from the kidneys and from the urine. It seemed an unique case in that respect.

A Method of Sequestrating the Urinary Bladder in Extensive Operations Involving its Peritoneal Surfaces. Dr. Kelly.

Often in women and invariably in men the most convenient avenue of approach to the bladder for the purpose of doing extensive or delicate surgical operations involving the vesical walls, is by the suprapubic route through the lower abdominal wall.

If an incision is made from 10 to 12 cm. in length, between the recti muscles, and these muscles are then detached from their pubic insertions for a short distance on either

side, convenient access is afforded to the bladder which may then be extensively detached from its anterior and lateral pelvic attachments and even from its peritoneal covering, so as to afford the operator every facility for performing an extra-peritoneal operation.

When, however, there are areas of ulceration or old inflammatory disease producing a localized thickening of the bladder wall, involving especially the area covered by peritoneum, it is often impossible to effect a detachment of the peritoneum without tearing it, and any radical suprapubic operation, removing the diseased portion, must necessarily expose the patient to the risks of a general peritoneal infection from the organisms invariably present within the diseased bladder.

In a patient at present under my care upon whom I operated, November 20, I adopted for the first time a course which effectually obviated these great risks, and inasmuch as the plan pursued promises to be permissible in all similar cases of cystic affections both male and female, I feel that it is worth while to record the procedure in full.

The patient referred to had a cystitis of several years' standing, and when I first saw the bladder it was universally inflamed, being of an intense deep angry red color; one of the most prominent symptoms was excessive hemorrhage with every act of urination. After about two years' treatment by drainage, irrigations, topical applications through my open cystoscopes and curettage, the bladder became entirely normal in every part except a granular patch in the posterior hemisphere on the left side about 4 by 3 cm. in extent, traversing the bladder from vertex to base. For a time after a year of vigorous campaign against the disease, there was a complete cessation of all symptoms, and the patient returned home apparently in perfect health, but after a few months the hemorrhages began again, and when she returned to me I determined at once upon a radical excision of the affected area which my treatments had failed to cure. The procedure adopted was the following: After making an incision through the abdominal muscles from the symphysis upward about 10 cm. in length, I tried to detach the peritoneum for about 6 or 8 cm. on either side, but in doing this it was torn and the abdominal cavity opened. Being unable to make the operation extra-peritoneal I took steps to sequestrate the bladder; there is a natural peritoneal pocket forming a clearly defined fossa between the uterine body in its normal anteposition and the symphysis pubis, and this area was utilized for the purpose of sequestration of the bladder by suturing the uterine cornua and the free margins of each round ligament to the parietal peritoneum of the anterior abdominal wall; and in the median line, where in this case peritoneum was not available, the omentum was utilized by suturing its free edge to the fundus of the uterus. Fig. 1.

After loosely packing the artificial pocket thus created with gauze, the empty bladder was opened at its vertex, the disease area located and a long wedge of tissue about 7 cm. in length and from 2 to 3 cm. in breadth was exsected including in its upper half the entire thickness of the hypertrophied vesical wall. The wound thus made traversed the entire peritoneal surface of the bladder, and extended on the inside well down to the *bas fond*. The incision was closed with cumol catgut sutures throughout; in the lower portion

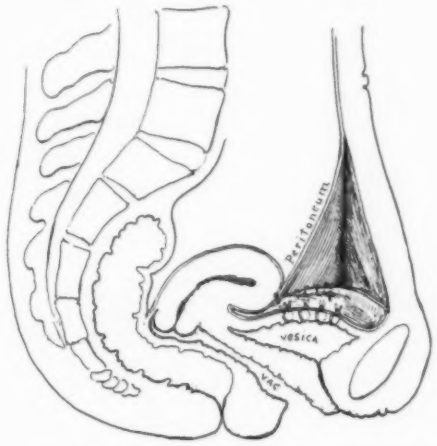

FIG. 1.—Shows peritoneum detached from the abdominal wall and sutured to the round ligament; a much lower detachment will often suffice. The bladder is represented sutured after an operation through its serous surface. The space between the peritoneum and the anterior face of the uterus above and the bladder below is the sequestrated area

passed and tied on the mucous surface of the bladder, in the upper part entering and emerging and tied on the peritoneal surface. Fig. 2. This new ante-uterine cavity formed by the suturing off of the peritoneum was finally loosely filled with a

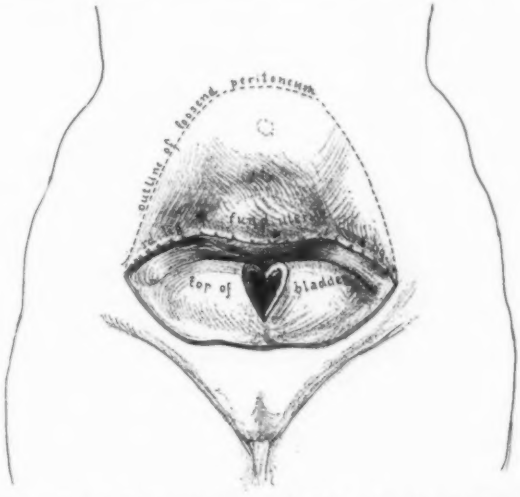

FIG. 2.—Shows the peritoneum detached and sutured transversely across the pelvis to uterus and both round ligaments. As a rule the detachment need only extend about half as high as shown in the figure

washed-out iodoform gauze pack brought out as a drain at the lower angle of the abdominal wound, which was next closed down to this point. Two weeks have elapsed since the operation, the pocket is obliterated and the patient has suffered

no pain and there has not been the slightest sign of peritoneal infection and her previous repeated febrile attacks have completely disappeared together with the hemorrhages. I feel sure as I have claimed at the outset that the principle of sequestration thus successfully applied, in this instance, is a valuable procedure and one which is applicable in the vesical surgery of both sexes. In a deliberate procedure the peritoneum should be detached only a short distance above the symphysis and then for some 6 or 8 cm. on either side of the lower part of the abdominal wound; after effecting this de-

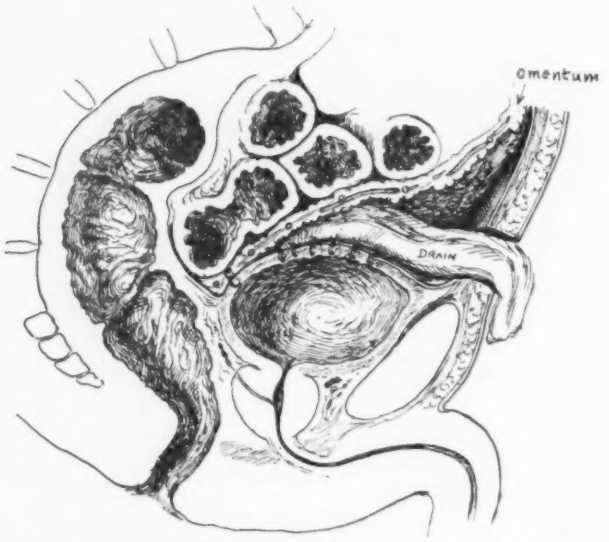

FIG. 3.—Shows the omentum attached below the bladder in the male pelvis and a drain introduced into the new formed retro-vesical space. The bladder is represented as pictured after an operation.

tachment it should then be incised transversely and as near the bladder as possible; the apron of peritoneum thus formed may then be successfuly stitched across the front of the uterus and to the margins of the round ligaments in women, or in the male, to the base of the bladder or even across the front of the rectum.

When the peritoneum cannot be detached in this way, and when it proves too friable for satisfactory suturing, the omentum may be used to take its place, either by simply suturing the free omental border transversely across the pelvis, and so forming a pre-omental peritoneal space which will probably be sufficient to limit an infection, or by attaching the omentum first by its free border in the manner just indicated and then again stitching it as well across the anterior abdominal wall at a point about 10 or 12 cm. from its free border, in this way decidedly limiting the pre-omental cavity to be drained. In suturing the omentum its vessels should be avoided. (Fig. 3.) I believe catgut sutures will last long enough to promote the necessary adhesions and to sequestrate the newly constructed retrovesical peritoneal pocket; there can, however, be no objection to the use of very fine silk for this purpose.

If the omentum is short and the parietal peritoneum cannot be used I would then proceed by suturing the round ligaments and afterwards the uterine body to the anterior abdominal wall.

If the pelvis is well packed with gauze the vesical operation could be performed first and the sequestration procedure at the close of the operation.

Discussion.

DR. HUNNER.—I assisted Dr. Kelly with the case reported and the sequestration was very effective.

I think, however, that objection might be urged against the suggested fixation of the omentum, as I am about to report two cases in which omental adhesions to old operation wounds caused serious symptoms simulating gall-stone colic. This sequestration operation in women must necessarily be limited to those who will not again become pregnant because of the firm adhesions that must result from the fixation of the uterus and round ligaments.

Gonococcal Suppurative Myositis. DR. HARRIS and MR. HASKELL.

To appear later.

Discussion.

DR. RANDOLPH.—I have been much interested in the communication of Dr. Harris. The cases which have been under discussion are those in which the metastases followed gonorrhœa of the genitals but there are at least three cases recorded in which metastatic inflammation resulted, when the primary lesion was in the eye, in other words after ophthalmia neonatorum. The most recent case is one reported by Paulsen. The child developed blennorrhœa of the conjunctiva on the third day. The disease ran a perfectly uneventful course and yielded well to treatment. On the eleventh day the left knee became swollen and that was followed by a swelling of the right knee. A considerable quantity of exudate was aspirated from the knee and a pure culture of the gonococcus was revealed. Those who are engaged in the lying-in service, especially outside of the hospital, might bear this possibility in mind when they meet with cases of ophthalmia neonatorum and examine the joints for conditions described by Paulsen and others. It is evident that a slight involvement of the joint could occur and not attract any attention.

I presume you all know that there is a form of iritis known as "gonorrhœal iritis" and it is supposed that this form of inflammation is due to the presence within the eyeball of the toxins of the gonococcus; certainly not to the presence of the organisms themselves, for when these organisms have once entered the eye destructive panophthalmitis ensues and we all know the intensity of the reaction, when the conjunctiva is attacked. While gonorrhœal iritis is sometimes stubborn its clinical picture does not suggest the presence of the gonococcus itself.

DR. HARRIS.—I think Wasselmann did not mean us to understand that the toxins were a soluble or circulating

toxine but derived from broken down organisms elsewhere. As soon as death occurs the cell breaks down and thus sets free its intracellular poison.

Syphilis of Peripheral Nerves. MR. REMSEN.

To appear later.

DISCUSSION.

DR. MACCALLUM.—There are several elements of interest in this case. The man had been vaccinated and dates his whole trouble from that time, but whether or not the infection actually occurred then, we cannot definitely decide. The lesion in the lung resembles so closely that in the arm that they have been regarded as part of the same process but of course when such large caseous masses are found in the lung, the question as to whether we are dealing with a syphilitic or a tuberculous process always arises. In this case unfortunately inoculation experiments were not carried out at the time of the autopsy, but from the fact that there are no typical tuberculous lesions in any other organs, even in the bronchial lymph glands, it seems probable that the affection may be of some different nature. No typical tubercles are found in this lung either, but simply large caseous masses, surrounded by fibrous tissue, and patient search has failed to reveal any tubercle bacilli, so that it seems justifiable to regard these caseous masses as gummata.

INSTRUCTION IN PSYCHIATRY AND NEURO-PATHOLOGY.

A limited number of graduates in medicine can have an opportunity for work in the laboratory of the Sheppard and Enoch Pratt Hospital.

Instruction in neuro-pathology will be given by the director of the laboratory, and those attending the course will be permitted to attend the clinical and other conferences of the medical staff. Clinical forms of insanity will be discussed, as well as the hospital and home care of the insane.

Physicians taking this course will also have an opportunity to attend the neurological clinics at the Johns Hopkins Hospital.

For particulars, apply by letter to Dr. E. N. Brush, Physician-in-Chief and Superintendent, Sheppard and Enoch Pratt Hospital, Station "A," Baltimore.

NOTES ON NEW BOOKS.

The Thirty-third Annual Report of the State Board of Health of Massachusetts. (*Boston: Wright & Potter, 1902.*)

This report shows the work of the Board for the year ending September 30, 1901, except that the records relating to water supply and sewerage are for the calendar year 1901.

The general death rate of the State for this year was the lowest recorded to date, 16.82 per 1000, the next lowest being 17 per 1000 in 1867, and the next 17.33 in 1859. Although hygienic improvement must receive a due share of credit, immigration is a factor also, 67.8 per cent of immigrants being between 15 and 40 years of age and only about 10.2 per cent over 40. As these persons grow older, the death rate may be expected to rise.

As compared with 1900, a general decrease in deaths from infectious diseases occurred. Of eleven infectious diseases, two, smallpox and cholera infantum, showed an increase aggregating 406, the remainder showing decreases aggregating 1401.

Smallpox.—In 1899, 105 *cases* were reported; in 1900, 104 *cases*, and in 1901, 778 cases and 97 *deaths*. During the latter year, the *cases* reported rose from about 6 per month during the first third of the year to 274 cases in December. Of these cases 407 had not been vaccinated at all, 251 (adults) had been vaccinated only in infancy, and the facts concerning 13 were unknown, leaving 107 vaccinated who contracted the disease after vaccination during adult life. Those of this class who yet contracted the disease, formed, roughly speaking, one-seventh of the whole number attacked. Of the total cases, more than one-half had not been vaccinated at all. It is well known that the greater part of the population has been vaccinated at some time or other, so that the much smaller unvaccinated portion supplied more than one-half the total number attacked. Another striking fact is that in the period 1888-1901, only 65 vaccinated persons under 15 years of age (i. e., cases where the vaccination could not have been more than 15 years old), were attacked, with *no* deaths, while during the same period, five times as many unvaccinated of the same age were attacked and more than 10 per cent of these died. The type of smallpox during this period was mild.

State Production of Vaccine Lymph.—Many considerations detailed in this report and elsewhere induced the Massachusetts State Board, certainly one of the first in this country in general standing, efficiency and reputation, to direct its efforts towards securing a State-directed vaccine laboratory. Ably seconded though this movement has been by the health authorities of the principal city of the State, by the Associated Boards of Health of the State and by the medical profession generally, this perfectly logical and reasonable proposition was rejected by the legislature owing largely to the influence of persons concerned in the commercial production of vaccine and to retail druggists. So far was this opposition carried that the making of diphtheria antitoxin by the State, under the high authority of Dr. Theobald Smith, is also now (1902) threatened with suspension after a most successful period of life-saving effort extending over eight years.

Diphtheria.—The case rate and death rate diminished considerably as compared with the previous year. This disease is subject to cyclical fluctuations and the records for 1902 point to an even greater diminution than those of 1901.

Typhoid Fever.—Shows the smallest number of deaths in any year since the beginning of registration in 1842.

Consumption.—In 1872, 5556 persons died from this disease. In 1901, with the population nearly doubled, the deaths had actually decreased, being 5033 in the latter year.

New Legislation.—Of the new acts relating to Public Health, the following are of interest:

1. Transferring the inspection and assay of liquors to the State Board of Health.

2. Requiring *personal examination* of the patient before a certificate of unfitness for vaccination is given.

3. Empowering the Board to publish monthly, in its own publication or in the public press, the names, etc., of firms whose products on analysis shall have been found adulterated.

4. Directing the Board, and also the Massachusetts Agricultural College, to investigate vaccine manufacture and report on a plan for State production.

The act requiring a personal examination of a child before giving a certificate of unfitness for vaccination became necessary

because unscrupulous physicians often filled in and gave such certificates without having seen the person purporting to require the certificate. The present act could itself be improved by requiring that a definite departure from normal health must exist and be certified to in terms before such a certificate receives standing. This because certain physicians maintain that the physical condition of everyone is such that vaccination will be harmful. Still better would it be to designate a special medical officer or the local Board of Health to pass upon the fitness of such children. Ample precedent for such action could be found in the appointment of medical examiners, coroners, etc.

Lawrence Experimental Station.—A special study of the effluents of filters of coarse materials was conducted by Mr. H. W. Clark, chemist of the Board, under the general supervision of Hiram F. Mills, M. A., C. E., a member of the Board. As compared with sand filters, the effluents of these coarse materials filters are rather uniformly turbid and poor in appearance, yet the effluents are high in nitrates and do not readily putrefy, in contrast with those turbid effluents sometimes yielded by sand filters under unfavorable conditions. The matters in suspension passing through a coarse filter on the "intermittent continuous" system are affected without being liquefied or removed, so that they are no longer highly putrescible. The sludge from ordinary sewage is still highly putrescible, but the sludge from the turbid effluent of a coarse filter more nearly resembles the humus of ordinary loam. Various details are given, with full descriptions of various experiments on this and cognate subjects. Mr. Clark also reports on the experiments relating to the Springfield water supply.

Mr. Gage contributes a paper on bacteriological studies with special reference to B. coli, and on species differentiation, with a proposed classification of bacteria, which, as Mr. Gage states, was suggested by Arthur I. Kendall. Mr. Kendall and Mr. Gage have carried out Mr. Kendall's outline in practice, independently of each other, arriving at very closely similar results. Both have presented the results in public. When publication permits detailed comparison, it will be interesting to determine exactly what the differences may be.

Food and Drug Inspection.—Very instructive and interesting results are given, together with valuable descriptions of test methods. Amongst the latter are quick methods for detecting preservatives in milk, detection of oleomargarine, identification of foreign coloring matter in butter, tests for flavoring extracts, tests for glucose in honey, etc. An interesting fact is that the percentage of adulteration of samples of capsicum bought from druggists was greater than the percentage of adulterated samples obtained from grocers. As pointed out in previous reports, the higher prices of the drug store sometimes induces an unfounded confidence in the superiority of their wares.

Antitoxin.—The report of Dr. Theobald Smith, always interesting, demands greater attention because of the threatened suspension of the work due to commercial influences as already outlined. A number of letters are quoted, received from various local authorities in the cities and towns of the State and showing that but for the free distribution of the State antitoxin, many diphtheria cases would have been denied the advantages of this treatment, varying from 25 per cent to 75 per cent, and even 90 per cent of the cases in different localities.

The advantage of early administration is particularly emphasized. A summary for seven years shows an average fatality of 10.4 per cent in the 12,730 cases treated. Of 4181 cases treated within the first forty-eight hours, 6.6 per cent died, while of the remainder, the death rate rises with increased delay, so that of those treated on the sixth day or later, 17.8 per cent died, nearly three times as great a proportion. Although not so suggested in the report, these figures furnish a potent argument for free antitoxin, since a poor man, not fully understanding the danger of delay, will often hesitate to involve himself in expenses which when later developments force him to assume them, may then prove unavailing. With free antitoxin, delay on this account need never occur.

Under Health of Towns, Medical Inspector Morse records the results of investigations made of epidemics in various parts of the State. In Adams, he traced typhoid to milk; in Salem and Beverly, scarlet fever seems to have similarly originated. A table of examinations for smallpox is also given.

HIBBERT WINSLOW HILL.

A System of Physiological Therapeutics. Edited by Solomon Solis Cohen, A. M., M. D. Vol. IX. Hydrotherapy, Thermotherapy, Phototherapy, Mineral Waters, Baths. (*Philadelphia: P. Blakiston's Son & Co., 1902.*)

Part I of the present volume, written by Dr. Wilhelm Winternitz, deals fully with the physiologic basis of the therapeutic uses of water and light. The whole subject is viewed from a broad standpoint and is handled in a most interesting way, these chapters thus forming a fitting introduction to the more practical portion of the work. In Part II the technic and various methods of hydrotherapy are described by Dr. Alois Strasser, while Part III, by Dr. E. Bruxbaum, indicates with precision the various procedures which are applicable to different forms of disease. Supplementary chapters on Heliotherapy, Phototherapy and Thermotherapy are contributed by Dr. J. H. Kellogg, while the subject of saline infusions and irrigations, by Dr. Harvey Cushing, forms an interesting and instructive chapter.

Balneology and Crounotherapy (drinking-cures) are dealt with by Dr. E. Heinrich Kisch, notes on American Springs being contributed by Dr. Guy Hinsdale. This part of the work is prefaced by a classification of mineral waters, with especial reference to those of the United States, by Albert C. Peale.

The authors are especially to be congratulated upon the fact that they have not hesitated to go into detail and have supplied the book with figures illustrating not only the more elaborate but also the simplest procedures. Had the medical profession not allowed Pindar's aphorism, "Water is the best thing of all," to be forgotten; had an intelligent system of hydrotherapy been gradually evolved from his time, and great fundamental truths not have been allowed to become obscured by a thousand "ologies" and polypharmacy, we should have been spared the trouble of rediscovering a lost art and rescuing it from amid a mass of charlatanry and superstition.

To a large extent the present volume will be useful mainly as a reference book, but its practical tone cannot fail to recommend it to the general practitioner. Water, internally and externally, light, fresh air, heat and cold, even without expensive and elaborate appliances, can be made to subserve many therapeutic uses, and the work, while containing some things that smack a little of the enthusiasm of the specialist, and recommending not a few procedures that are beyond the reach of the men who cannot command a sanatorium or a hospital, supplies many very valuable hints whereby a rational adaptation of these valuable agents amid more humble surroundings is rendered easier, so that their field of usefulness can be much more widely extended than would at first sight have appeared possible.

Manual of Gynecology. By Henry T. Byford, Professor of Gynecology in the College of Physicians and Surgeons of Chicago. Third revised edition. 598 pages. 363 illustrations. (*Philadelphia: P. Blakiston's Son & Co.*)

To the new edition of this manual the author has added considerable new matter and has rearranged several of the chapters. It is a concise and practical work for the student and general practitioner, neither so voluminous as the more extensive works on the subject, nor so puerile as the average quiz compend. It is comprehensive and its teachings can be safely followed.

The illustrations, with the exception of the reproduced photographs of pathological specimens, are clear and well chosen. The press work is excellent.

Die Röntgenstrahlen im Dienste der Chirurgie. By Dr. Carl Beck. (*München: Verlagsbuchhandlung, Seitz & Schauer.*)

The work consists of two parts. Part I, of 138 pages, deals with the technique and general principles of the production of the X-ray, its value to surgery and its therapeutic worth.

After a brief introduction, Dr. Beck devotes a section to equipment. In common with most radiographers, he advises a coil with a sparking distance of not less than 40 cm., in conjunction with an electrolytic or mercury interruptor. He justly, however, considers the tube the most important factor in the equipment, and shows that only by good judgment in its selection can one produce good radiographs. In taking a radiograph he advises placing the tube only 12 cm. from the patient. This is contrary to the general opinion, as by so doing both clearness and definition are lost, and the danger of burning the patient is increased.

The subject matter is dealt with in sections corresponding to the anatomical divisions, as head, thorax, abdomen and extremities. The various lesions of these parts are illustrated by the plates in Part II. In the discussion of the radiograph he emphasizes the importance of a proper interpretation of the negative.

In the section devoted to the abdomen considerable attention is paid to the different forms of biliary, renal and vesical calculi. His results, especially in the cases of biliary calculi, are apparently far superior to those obtained by other radiographers. He even goes so far as to differentiate between the various forms of stones.

The last section is devoted to burns and the therapeutics of the X-ray. He recognizes three degrees of burns, the first being the stage of erythema; the second, that of the formation of vesicles, and the third, that of ulcers and sloughs. The fundamental principle in his theory is that the formation of toxic substances in the tissues, following X-ray exposure, plays an important part in the production of burns.

In the treatment of malignant growths he finds that the epitheliomata respond the most readily to treatment. The knife, however, should be used first and then the X-rays employed to prevent a recurrence.

Part II is made up of 65 plates illustrating the cases in Part I, and various other interesting lesions. The plates, which are half-tones, are for the most part poor. The exceptions are those of biliary and vesical calculi, which come out with such startling clearness as to suggest a retouching of the negatives.

The arrangement of the sections is bad, and the book not being indexed, is practically useless for reference purposes. The plates in Part II are such poor reproductions as hardly to be worth looking over. The author appears to go beyond the province of the book when he discusses surgical methods and procedures in the various cases. Although the book is well written, it adds little to our knowledge nor is it of value to the beginner, for the reason that it does not go sufficiently into details.

American Edition of Nothnagel's Practice. Diseases of the Bronchi and Pleura; Pneumonia. By various authors and edited by John H. Musser, M. D., of Philadelphia. (*Philadelphia and London: W. B. Saunders & Co., 1902.*)

The volumes of a system of medicine should not be expected to be of equal merit. One watches with interest the varying styles of the different articles. In reviewing this volume these differences are specially brought to mind, and one rather suspects that to Dr. Musser has fallen a heavier task than to some of his fellow editors of the American edition. Perspicuity is a virtue sometimes lacking in our German friends—not that this is confined to them—and parts of this volume may be quoted as examples. The translator has not always been very happy in his part. Doubtless the original is often involved and the sentences complicated, but these should be all the more reasons for clear English. Many of the sentences are on first reading quite obscure. Dr. Musser is to be congratulated on his part. Throughout the book his additions and notes are timely and well put. They are in places the best part of the section.

The book opens with the diseases of the bronchi, by Dr. Hoffmann, of Leipsic. The anatomy of the bronchi is first taken up. Then follows a lengthy section on foreign bodies in the bronchi. Bronchitis is discussed at some length, the author giving fifteen varieties. His discussion of the whole subject cannot be called illuminating. There are occasional flashes of light worthy of note; for example, he says of capillary bronchitis that "In truth next to nothing has been proved concerning it." The treatment advised for bronchitis is first, hydrotherapy in the form of compresses, affusions, packs, and in some cases cold douches or hot baths; and second, inhalations and respiratory gymnastics with local applications in some cases. The usual treatment by drugs he considers as pure empiricism. His points against blind polypharmacy are well taken. Under Fibrinous Bronchitis we are glad to see that Dr. Musser has referred very fully to Bettmann's work on the subject. The cases of bronchiectasis are divided into four groups, of which only two are important; these are the inflammatory, which is usually called saccular, and the vicarious, usually termed cylindric. The main etiological factor in the former he considers to be stenosis and a continuous excess of pressure. In the treatment the editor draws attention to two important points, namely, the postural method by raising the foot of the bed and so favoring drainage, and the use of inhalations of creosote vapor. The articles on asthma and emphysema are also contributed by Dr. Hoffmann.

Dr. Aufrecht, of Magdeburg, writes on Inflammations of the Lungs. It is not possible to review this in detail. We may look at the section on the treatment of pneumonia, following the practice of an old reviewer, who said that he always based his opinion of a text-book of medicine on the section dealing with the treatment of pneumonia. Dr. Aufrecht's treatment may be briefly given as morphia if necessary for the pain or cough and an ice bag to the affected side. If the patient has had previous cardiac trouble, digitalis is advised, but these cases he considers rare. Otherwise he gives quinine and iron. He advises distinctly against the use of stimulants unless in collapse. In cases with more marked symptoms and toxæmia a hypodermic injection of 7½ grains of quinine hydrochlorate is advised. This may be repeated. For delirium chloral is advised. We should consider his treatment as quite suitable in mild cases, but for severe ones it seems rather inadequate.

Diseases of the pleura are taken up by Dr. Rosenbäch, of Berlin. These articles are in many ways good, but to one who has not already his knowledge of these subjects well arranged they are likely to be rather confusing. There is much theoretical discussion. One misses a good description of thickened pleura.

This book will be useful for reference and to those who have some knowledge of the subjects discussed. But to a student or to one who seeks a clear, definite idea of the subjects treated it is likely to prove very disappointing.

Atlas and Epitome of Traumatic Fractures and Dislocations. By Professor Dr. H. Helferich, Professor of Surgery at the Royal University, Greifswald, Prussia. Edited, with additions, by Joseph C. Bloodgood, M. D., Associate in Surgery, Johns Hopkins University, Baltimore. From the fifth revised and enlarged German edition. With 216 colored illustrations on 64 lithographic plates, 190 text-cuts, and 353 pages of text. (*Philadelphia and London: W. B. Saunders & Co., 1902.*) Cloth, $3.00 net.

The Treatment of Fractures. By Chas. L. Scudder, M. D., Assistant in Clinical and Operative Surgery, Harvard Medical School. Third edition, revised and enlarged. Octavo, 480 pages, with 645 original illustrations. (*Philadelphia and London: W. B. Saunders & Co., 1902.*) Polished buckram, $4.50 net; half morocco, $5.50 net.

The authors of both the above books declare their intention of providing a manual which shall serve as a practical guide for the surgeon. Dr. Helferich, welcoming "the opportunity to use the specimens and drawings collected in the course of years," has produced a book whose colored plates convey to the eye perfect pictures of the anatomical conditions present in fractures; while Dr. Scudder's one aim is to help the student determine "how to meet the conditions found in each individual case of fracture." To illustrate the different methods of approaching the subject, compare the sections on fracture of the neck of the humerus, or of the femur, in the two books. Dr. Helferich's anatomical and pathological plates, prepared from his own complete collection, are certainly more vivid than the sketches in Dr. Scudder's book; on the other hand, the methods of recognizing the nature of the injury, and above all, the explicit directions for treatment (whose simplicity commends itself to the American surgeon), receive far more attention in the latter. The sections on the after-care of the patient are also more satisfactory in Dr. Scudder's book.

The plates illustrating Kocher's method of reducing subcoracoid dislocations of the humerus, as well as the plates showing the anatomical conditions in dislocations of the hip, are especially noteworthy in Dr. Helferich's book. One heartily endorses the note of the American editor in which he criticises the cumbersomeness of many of the dressings. Dr. Bloodgood's remarks have added not a little to the value of the book.

In Dr. Scudder's book, the addition of clear photographs of the normal scapula and of fractures of the vertebræ, as well as of the chapter on gunshot wounds of bone, have made the new edition more indispensable than ever.

It is scarcely necessary to add that, for the American surgeon, Dr. Scudder's is by far the more important and useful book.

Diseases of the Stomach. By John C. Hemmeter, M. D. Third edition. (*Philadelphia: P. Blakiston's Son & Co., 1902.*)

The appearance of the third edition is a good proof of the popularity of this work. When the previous editions have been noticed there is little additional to be said of the third. One of the valuable features of the work is the bibliography, and this Dr. Hemmeter has brought up to date. As the author says, succeeding editions of a text-book largely reflect the general activity of work in its special domain.

A Treatise on the Diseases of the Eye, Nose, Throat and Ear. For Students and Practitioners. By Various Authors. Edited by William Campbell Posey, A. B., M. D., Professor of Ophthalmology in the Philadelphia Polyclinic; Surgeon to the Wills Eye Hospital; Ophthalmic Surgeon to the Howard and Epileptic Hospitals; Member of the American Ophthalmological Society; and Jonathan Wright, M. D., Attending Laryngologist to the Kings County Hospital; Laryngologist to the Brooklyn Eye and Ear Hospital; Surgeon to the Manhattan Eye and Ear Hospital Throat Department; Pathologist to the Manhattan Eye and Ear Hospital. Illustrated with 650 engravings and 35 plates in colors and monochrome. (*Philadelphia and New York: Lea Brothers & Co., 1903.*)

This system is similar to "An American Text-book of Diseases of the Eye, Ear, Nose and Throat," not only in its general features but also in the fact that ten of its contributors are to be found in the list of those who wrote for the latter work. The work of Posey and Wright is undoubtedly a valuable and practical collection of knowledge, as one would infer from a glance at the names of those who have taken part in its production—27 in all: Examination of the Eye, by William Campbell Posey, M. D. The Physiology of Vision, by William Norwood Suter, M. D. Refractive Errors in General, by Alexander Duane, M. D. The Motions of the Eyeball and Their Derangements, by Casey A. Wood, M. D. Diseases of the Orbit, Lachrymal Apparatus and Lids, by R. A. Reeve, M. D. Diseases of the Conjunctiva, Cornea, and Sclera, by John E. Weeks, M. D. Embryology of the Eye; Anomalies, Diseases, and Injuries of the Iris, Ciliary Body, Choroid, and Vitreous, by H. V. Würdemann, M. D. Sympathetic Ophthalmia, by H. Gifford, M. D. Diseases of the Retina, Optic Nerve, and its Cerebral Origin, by T. Holmes Spicer, F. R. C. S. Eng. Diseases of the Crystalline Lens, by Edward C. Ellett, M. D. Glaucoma, by E. Treacher Collins, F. R. C. S. Eng. Disturbances of Vision without Apparent Lesion, by Elmer G. Starr, M. D. The Eye in Its Relation to General Diseases, by C. F. Clark, M. D. General Preparation for Operations on the Eye, by Clarence A. Veasey, A. M., M. D. The Technique of the Pathological and Bacteriological Examinations of the Eye, by Edward A. Shumway, B. S., M. D.

The Histological Pathology of Diseases of the Nose and Throat, by J. L. Goodale, M. D. Methods of Examination; Instruments and Apparatus and Their Use, by J. E. Newcomb, M. D. Inflammatory Diseases of the Upper Air Passages; Hay Fever; Rhinorrhea; Asthma; Influenza, by Charles W. Richardson, M. D. Diphtheria of Nose and Throat; Intubation; Syphilis, Tuberculosis, Lupus and Leprosy of Nose and Throat; Chronic Laryngeal Stenosis; Foreign Bodies in Nose and Throat; Rhinoliths, by William Kelly Simpson, M. D. Neoplasms of the Nose and Larynx; The Local, Medicinal, and Surgical Treatment of the Larynx, by W. E. Casselberry, M. D. Diseases of the Accessory Sinuses, by St. Clair Thompson, M. D., F. R. C. S. Eng. Diseases of the Oropharynx and Nasopharynx, by H. S. Birkett, M. D. Neuroses of the Nose and Throat, by Emil Mayer, M. D. External Deformities of the Nose; Cleft Palate, by F. E. Hopkins, M. D.

Examination of the Ear; Diseases of the External Ear; Diseases of the External Auditory Meatus; Otomycosis; Foreign Bodies; Wounds of the Membrana Tympani, by F. E. Hopkins, M. D. Diseases of the Internal Ear and Auditory Nerve; Deaf Mutism, by E. A. Crockett, M. D. Purulent Inflammation of the Middle Ear, by Henry Arnold Alderton, M. D. Chronic Non-Suppurative Middle-Ear Disease, by Arthur H. Cheatle, F. R. C. S. Eng.

So far as simple perusal goes, a single style, the product of one individual, would be more pleasing, but in this event the authority which is found in a multitude of counselors would be absent. It is evident, however, that a detailed review of such a work would be tiresome, and we think in this case it would be unnecessary, for while there are some things which call for adverse criticism, on the whole the book is a distinct success, and we are confident that it will fulfil the aims of its editors and win popularity among students and practitioners. Attention must be called to indications of carelessness, as for instance on page 304 a disastrous attempt is made to give the name of the investigator of Oyster Shuckers' Keratitis. Again, on page 590, Königstein, the well-known Vienna ophthalmologist, might find fault with the appearance of his name. On page 593 the name of Cheatham, of Louisville, is misspelled. In a work of this character these things are inexcusable. It is well printed on good paper, and the illustrations for the most part are all that could be desired.

BOOKS RECEIVED.

A Nurse's Guide for the Operating Room. By Nicholas Senn, M. D., Ph. D., LL. D., C. M. 1902. 8vo. 131 pages. W. T. Keener & Co., Chicago, Ill.

A Manual of Medical Treatment or Clinical Therapeutics. By I. Burney Yeo, M. D., F. R. C. P. Tenth Edition. Two volumes. 1902. 12mo. W. T. Keener & Co., Chicago.

Clinical Methods. A Guide to the Practical Study of Medicine. By Robert Hutchison, M. D., M. R. C. P., and Harry Rainy, M. A., F. R. C. P. Ed., F. R. S. C. Fifth edition. With upwards of 150 illustrations and 8 colored plates. 1902. 16mo. 612 pages. W. T. Keener & Co., Chicago.

Manual of Gynecology. By Henry T. Byford, M. D. Third revised edition. Containing 363 illustrations, many of which are original. 1902. 8vo. 598 pages. P. Blakiston's Son & Co., Philadelphia.

A Text-Book of Pathology and Pathological Anatomy. By Dr. Hans Schmaus. Translated from the sixth German edition by A. E. Thayer, M. D. Edited with additions by James Ewing, M. D. Illustrated with 351 engravings, including 35 colored inset plates. 1902. 8vo. 602 pages. Lea Bros. & Co., Philadelphia and New York.

A Text-Book of Anatomy. By American Authors. Edited by Frederic Henry Gerrish, M. D. Second edition, revised and enlarged. Illustrated with 1003 engravings in black and colors. 1902. 4to. 944 pages. Lea Bros. & Co., Philadelphia and New York.

Transactions of the State Medical Association of Texas. Thirty-fourth annual session held at Dallas, Texas, May 6, 7, 8 and 9, 1902. 8vo. 587 pages. Austin, Texas.

A Handbook of Materia Medica, Pharmacy and Therapeutics. Including the Physiological Action of Drugs, the Special Therapeutics of Disease, Official and Practical Pharmacy, and Minute Directions for Prescription Writing. By Samuel O. L. Potter, A. M., M. D., M. R. C. P. Lond. Ninth edition, revised and enlarged. 1902. 8vo. 951 pages. P. Blakiston's Son & Co., Philadelphia.

Transactions of the State Medical Society of Wisconsin. Volume XXXVI. For the year 1902. Constitution and By-Laws and List of Members. 8vo. 474 pages. Madison, Wis.

Transactions of the Association of American Physicians. Seventeenth session held at Washington, D. C., April 29 and 30, 1902. Volume XVII. 8vo. 667 pages. Printed for the Association, Philadelphia.

Text-Book of Medical Jurisprudence and Toxicology. By John J. Reese, M. D. Sixth edition revised by Henry Leffmann, A. M., M. D. 1902. 8vo. 660 pages. P. Blakiston's Son & Co., Philadelphia.

The Development of the Human Body. A Manual of Human Embryology. By J. Playfair McMurrich, A. M., Ph. D. With 270 illustrations. 1902. 8vo. 527 pages. P. Blakiston's Son & Co., Philadelphia.

A Treatise on Diseases of the Eye, Nose, Throat and Ear. For Students and Practitioners. By Various Authors. Edited by William Campbell Posey, A. B., M. D., and Jonathan Wright, M. D. Illustrated with 650 engravings and 35 plates in colors and monochrome. 1903. 8vo. 1238 pages. Lea Bros. & Co., Philadelphia and New York.

The Story of a Living Temple. A Study of the Human Body. By Frederick M. Rossiter, B. S., M. D., and Mary Henry Rossiter, A. M. 1902. 12mo. 348 pages. Fleming H. Revell Company, Chicago, New York, Toronto.

Diseases of the Pancreas and Their Surgical Treatment. By A. W. Mayo Robson, F. R. C. S., and B. G. A. Moynihan, M. S. (Lond.), F. R. C. S. Illustrated. 1903. 8vo. 293 pages. W. B. Saunders & Co., Philadelphia and London.

Medical Microscopy. Designed for Students in Laboratory Work and for Practitioners. By T. E. Oertel, M. D. With 131 illustrations, some of which are colored. 1902. 8vo. 362 pages. P. Blakiston's Son & Co., Philadelphia.

The Elements of Bacteriological Technique. A Laboratory Guide for the Medical, Dental and Technical Student. By J. W. H. Eyre, M. D., M. S., F. R. S. Edin. With 170 illustrations. 371 pages. 1902. 8vo. W. B. Saunders & Co., Philadelphia and London.

Lessons and Laboratory Exercises in Bacteriology. An Outline of Technical Methods Introductory to the Systematic Study and Identification of Bacteria. Arranged for the use of students. By Allen J. Smith, M. D. 1902. 8vo. 298 pages. P. Blakiston's Son & Co., Philadelphia.

American Edition of Nothnagel's Practice. Diseases of the Bronchi, Lungs and Pleura. By Prof. Dr. Friedrich A. Hoffmann, Prof. Dr. O. Rosenbach, Dr. E. Aufrecht. Edited, with additions, by John H. Musser, M. D. Authorized translation from the German, under the editorial supervision of Alfred Stengel, M. D. 1902. 8vo. 1029 pages. W. B. Saunders & Co., Philadelphia and London.

The American Text-Book of Obstetrics. For Practitioners and Students. By James C. Cameron, M. D., *et al.* Richard C. Norris, M. D., Editor. Robert L. Dickinson, M. D., Art Editor. With nearly 900 illustrations. Second edition, revised. Two volumes. 1902. 4to. W. B. Saunders & Co., Philadelphia and London.

Twenty-third Annual Report of the State Board of Health of Massachusetts. 1901. 8vo. xlvii + 615 pages. 1902. Wright & Potter Printing Co., Boston.

Diseases of the Eye. A Handbook of Ophthalmic Practice for Students and Practitioners. By G. E. de Schweinitz, A. M., M. D. Fourth edition, thoroughly revised. With 280 illustrations and six chromo-lithographic plates. 1903. 8vo. 773 pages. W. B. Saunders & Co., Philadelphia and London.

Index Catalogue of the Library of the Surgeon General's Office, United States Army. Authors and Subjects. Second Series. Vol. VII. Hernia-Inquiry. 1902. 4to. 1003 pages. Government Printing Office, Washington.

Progressive Medicine. A Quarterly Digest of Advances, Discoveries and Improvements in the Medical and Surgical Sciences. Edited by Hobart Amory Hare, M. D., assisted by H. R. M. Landis, M. D. Volume IV. December, 1902. 8vo. 422 pages. 1902. Lea Bros. & Co., Philadelphia and New York.

Transactions of the American Surgical Association. Volume the Twentieth. Edited by Richard H. Harte, M. D. 8vo. 1902. xxviii + 571 pages. Printed for the Association, Philadelphia.

Transactions of the Twenty-fourth Annual Meeting of the American Laryngological Association, held at Boston, Mass., May 26, 27 and 28, 1902. 8vo. 259 pages. New York.

Transactions of the Medical Society of London. Volume the Twenty-fifth. Edited by Arthur Francis Voelcker, M. D., F. R. C. P., and Jonathan Hutchinson, Junr., F. R. C. S. 1902. 8vo. 368 pages. Printed for the Society, London.

Atlas and Epitome of Human Histology and Microscopic Anatomy. By Doctor Johannes Sobotta. Edited, with extensive additions, by G. Carl Huber, M. D. Authorized translation from the German. With 171 illustrations on 80 lithographic plates, and 68 text illustrations. 1903. 12mo. 248 pages. W. B. Saunders & Co., Philadelphia and London.

Atlas and Epitome of Diseases of the Mouth, Pharynx and Nose. By Dr. L. Grünwald, of Munich. Second edition, revised and enlarged. Authorized translation from the German. Edited, with additions, by James E. Newcomb, M. D. With 102 illustrations on 42 lithographic plates, and 41 figures in the text. 1903. 12mo. 219 pages. W. B. Saunders & Co., Philadelphia & London.

Book on the Physician Himself, and Things that Concern His Reputation and Success. By D. W. Cathell, M. D. The Twentieth Century Edition. Being the eleventh edition revised and enlarged by the author and his son, William T. Cathell, A. M., M. D. 1902. 8vo. 411 pages. F. A. Davis Company, Philadelphia.

Golden Rules of Refraction. By Ernest E. Maddox, M. D., F. R. C. S. "Golden Rules" Series. No. XII. 32mo. 86 pages. John Wright & Co., Bristol; Simpkin, Marshall, Hamilton, Kent & Co., Lim., London.

Surgical Anatomy and Operative Surgery. For Students and Practitioners. By John J. McGrath, M. D. With 227 illustrations, including colors and half-tones. 1902. 8vo. 559 pages. F. A. Davis Company, Philadelphia.

Transactions of the American Gynecological Society. Volume 27. For the year 1902. 8vo. 446 pages. Philadelphia.

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